THE OLDEST RAILROAD JOURNAL IN THE WORLD
[Established 1832]

AMERICAN ENGINEER AND RAILROAD JOURNAL.

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE (INC.)
140 NASSAU STREET, NEW YORK

J. S. BONSALL, Vice-President and General Manager

F. H. THOMPSON, Eastern Advertising Manager.

R. V. WRIGHT, E. A. AVERILL, } Editors.

FEBRUARY, 1910

Subscriptions—$2.00 *a year for the United States and Canada;* $2.75 *a year to Foreign Countries embraced in the Universal Postal Union.*
Remit by Express Money Order, Draft or Post Office Order.
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RAILROAD LEGISLATION

THE PRESIDENT'S CONFERENCE WITH RAILWAY OFFICIALS IN ITS TRUE LIGHT.

It would be difficult to exaggerate the importance to the railroads, the industries depending upon them and the country in general of the spirit in which the administration programme for amendments to the Interstate Commerce Act has been discussed by the president and his advisors on the one hand and the railway executives and their representatives on the other.

Newspaper accounts published following the interview of six railway presidents with President Taft and Attorney-General Wickersham on January 3 gave an erroneous impression. These accounts misrepresented both parties. The AMERICAN ENGINEER has trustworthy information that the railway men, so far from presenting to the President a plea to be "let alone," or sulking, devoted their attention to broad, fair-minded discussion of changes which might be made in the text of the administration bill as it then stood. This was not with a view of thwarting the purposes of the President which he considers necessary to the public interest, but with a view to avoiding in the carrying out of those purposes needless injury to the railroads. The President met these advances in a similar spirit. When the bill was finally introduced on January 10 by Mr. Elkins in the Senate and Mr. Townsend in the House, it contained many important alterations inserted at the suggestion of the representatives of the carrying systems.

A significant confirmation of this account of the interview was given by President George A. Post of the Railway Business Association, which, of course, is energetic and resourceful in securing accurate information, in an address delivered on January 12 at a dinner of the New England Railroad Club in Boston.

"The railroad presidents," said Mr. Post, "were sought to be put in a bad light by the insinuation that they had been driven from the presidential presence empty handed and discomfited, with the inference that they had maintained merely an obstinate attitude of obstruction toward all the President's purposes and that he, in the interest of the people, had turned a deaf ear to everything and anything they had said. It was not true. This is not a proper treatment of such an important conference. It is not fair to the railroad managers; it is not fair to the people to be so misinformed. These railroad men are not enemies of our country; they are American citizens, men of ideas, men of action and men of honor.

"It would be strange, indeed, if the President of the United States could not learn from these men who have spent their lives in railroad service, some things of great importance and value to him as chief magistrate, which he did not know and could not learn except from such thoroughly informed men. It would be strange if railroad presidents with their views naturally colored by their intense desire to preserve adequate freedom of action in the administration of their properties, for the successful operation of which they are responsible, could not and did not learn from our wise, kindly, open-minded President, some things with regard to concessions necessary to make to public sentiment.

"The railways are not pursuing a policy of obstruction to the purposes of the Administration. It is to be hoped that this interview at the White House on January 3 will prove an augury of a new era, not only in dealing with the executive, but in the exchange of views before committees of Congress and in the preparation of state legislation."

It is needless to say that the method adopted by the present federal administration differs radically from that which has been pursued for years past by many executive and legislative officials in the nation and in the states. Moreover, a deep anxiety to be dead sure they are right before they proceed to the advocacy of new restrictions of railroads, is widely taking the place of a mastering desire to "do something" to the railroads and take chances as to its being right or wrong.

It would be grossly unfair, however, to those who in the past have been active in promoting regulatory measures not to say that one of the contributory causes of their state of mind was the attitude of the railway officials, which happily is passing away, as was illustrated by the tone in which the six railway presidents addressed the chief magistrate on January 3.

If, again, the railroad men in adopting toward the government an attitude of conciliation and of helpful suggestion have assured to themselves respectful consideration of their statements, and immunity, at least to a degree, from the violence which hitherto has characterized official feeling toward them, they have perhaps also placed themselves in position to enjoy another benefit of a more subtle kind, but it may be of some practical importance nevertheless. It will only be natural for those who are responsible for the successful management of these great properties to suffer very much less from fright over threats of legislation when they know that they are themselves taking a hand in the most honorable and above-board manner in the framing of the measures.

Any development which tends to minimize the apprehension of the railway officials as to the probably injurious effect of pending proposals is bound to be beneficent, not as tending to plunge the railways into extensions and improvements without adequate caution as to the possibility of future changes in conditions due to legislation, but as tending to give them reasonable reassurance. Upon such confidence among them and among those to whom they look for their security market depends in large measure whether the development of transportation facilities shall proceed in a stable and tranquil manner or by fits and starts, the ups involving over-extension in countless industries and the downs working proportionate havoc to all concerned.

If, through their organization formed for that purpose, the railway equipment and supply people have contributed in part to bringing about the more friendly relation now existing between the railway officials and those who regulate them, they are to be congratulated and they will be the first to say that there is glory enough for all.

WELFARE WORK ON THE CANADIAN PACIFIC RAILWAY.

The Canadian Pacific Railway recently issued a profusely illustrated pamphlet describing the welfare work carried on by it. The following abstract covers this work with the exception of that part referring to the steamship department, Dominion Express Co., floral work and the hotel department.

The captains of industry have not been slow to find out that it pays to treat their army of workers fairly, and that to give to them the very best tools, the most favorable conditions for the performance of their duties, is an investment productive of good returns.

Welfare work may be said to consist of the efforts of the management on behalf of the employee, over and above the payment of wages, in making him more comfortable and contented with his work, and robbing old age of its terrors by means of a pension fund. The management frankly confesses that considerate treatment toward its employees is a paying business. The new

improvements in equipment, and the enormous increase in traffic, have made railroading much more exacting in its requirements from the men who engage in it. This business, possibly more than any other, requires the clearest heads, the steadiest nerves and the strongest muscles, for the reputation of the road must always be safe-guarded. Therefore, the type of men operating the trains, building the cars and manning the ships is of the greatest interest and importance to the company. It is also important how its men spend their spare hours, when off duty, even though the company exercises no authority over them; it is willing to help to provide healthful, pleasant, wholesome recreation, and opportunities for mental and physical improvement.

Each year a larger amount of money is being devoted by the Canadian Pacific Railway Company to this special work for its employees. It has brought the men and the management into closer relationship. It has made the employees feel that the company takes a sympathetic interest in their welfare; that it is not merely trying to grind out the best years of their lives with exacting work, long hours and small pay without giving them anything to look forward to but retirement without compensation through disability or old age. This welfare or betterment work has done much to stamp out that spirit of discontent that once was prevalent among railway workers. It has generally raised the tone and character of the men, increasing their loyalty and efficiency, and helping them to realize that the success of the company that employs them means their own success, and that these both depend upon each worker doing well his own part.

Work for Apprentices.—The company has inaugurated at its Angus Works, Montreal, a new system for handling apprentices. This system, based on broad, common-sense lines, has become well established, and while probably much remains to be accomplished, the splendid progress made thus far and the strong organization which is being built up, promise well for the future. The management is not looking for immediate results, for it is far-sighted enough to look five, even ten, years ahead, feeling sure that its present efforts will be rewarded when that time elapses.

The young recruit, when seeking admission, has to satisfy the management as to his general intelligence and good health. When in the workshops, the future mechanic is put through a systematic and continuous training, which, upon completion of his apprenticeship, enables him to qualify for a mechanic's position, and then, by further instruction, advance to the highest position in the organization. Every facility is placed in the way of the ambitious and intelligent employee to receive instruction from qualified and experienced officials in shop and railroad work. The trend of this preliminary training has the tendency to create a desire in the aspiring employee. The training is progressive—starting first with educational instruction for the young employees, then advancing to shop and educational instruction for the apprentices, and finally the journeyman receives educational facilities which enable him to qualify for minor positions on the staff. The moral and physical side, as well as the mental, is covered by the training given.

The young employee, after he has received a training in reading and writing, elementary arithmetic, geography of the C. P. R. System, biographical sketches of past and present eminent Canadians, freehand drawing, punctuality and regularity, thoroughness, application and self-reliance, cleanliness, thrift and recreation, is put through courses of instruction in shop arithmetic, shop mechanics, shop practice and mechanical drawing, which enable him upon completion of his apprenticeship to qualify as a skilled mechanic. Then, if necessary, he may take advantage of the advanced classes in mechanics, electricity, locomotive and car construction, and workshop practice.

A very interesting feature of the training is the practical work of the boys in the workshops, which is carried on under the direction of skilled shop men who are termed shop instructors. These men are carefully selected, as they are held responsible for the moral as well as the practical training of the boys. The educational side of the training is carried on in a room set apart for the purpose, and well equipped with desks, tables, blackboards, cupboards, etc. The apprentices attend the instruction classes during working hours, and for the time thus spent are paid their regular wages. The instruction classes are under the charge of practical and technical trained men who are termed educational instructors.

In order to encourage the deserving apprentices, the company donates each year a scholarship to the ten best apprentices. These scholarships consist of complete courses in mechanical or electrical engineering, following the courses of the International Correspondence Schools, but taught by the company's own instructors. The company also awards two scholarships, tenable for four years at McGill University, Montreal, each year to sons of employees. The holders of these McGill University scholarships are employed by the company during vacation, and receive remuneration for their services.

A glance at the syllabus of the evening classes shows that the education given is upon very practical lines. Over 250 employees take advantage of these classes, the upkeep of which is chiefly borne by the men themselves but is assisted by the company and the educational department of the Province of Quebec. Last year several officials of the company awarded prizes to successful employees attending evening classes.

Instruction in Telegraphy and Shorthand.—The young clerks in the general and other offices at Montreal have equal opportunities with the apprentices in the shops for equipping themselves for their life work. Schools of telegraphy and shorthand have been in operation for some time, and the advantages they offer are being eagerly seized by a number of ambitions youths. There are two terms each year, and the classes meet three evenings a week, when the students of telegraphy are instructed in the mysteries of the key, taught how to dispatch trains, etc., etc. In the shorthand school Isaac Pitman's system is used. To ensure a regular attendance a monthly fee of $2.00 is charged each pupil, but this money is refunded in full at the end of the six months' term to the pupils who have attended 75 per cent. of the classes.

Instruction Cars for the Education of Employees.—The company provides instruction cars with competent men in charge to give instruction in the mechanism, operation and care of the Westinghouse air-brake, steam-heating and safety appliances. One of these cars is employed on Western Lines and another on Eastern Lines. The cars are equipped with stereopticon outfits and full sets of slides, so that illustrated lectures can be given to classes.

First Aid to the Injured.—For giving prompt assistance in case of accidents there is an organization called the Canadian Pacific Railway Center of the St. John Ambulance Association, which includes in its scope all employees of the Canadian Pacific Railway Company. Its object is not to rival, but to assist, the medical profession. First aid is quite distinct from the work of the surgeon, for where the work of the ambulance man ends that of the surgeon commences.

During the past three months first aid has been rendered to more than one hundred personal injuries at the Angus shops, including fractures to different parts of the body, dislocations, electric shocks, burns, scalds, severed arteries, injuries to the eye, and many more or less severe accidents. Many cases of blood poisoning have undoubtedly been prevented by having at immediate call men who can treat wounds by antiseptic dressings before bleeding has entirely stopped, as it is after bleeding has stopped that bacteria find their way into an open wound. In case of severed arteries there was an undoubted saving of life, as it is practically impossible for medical aid to reach the patient in time to save life in case of arterial bleeding. A great deal of suffering has been avoided by treating for shock immediately after the accident has occurred.

Quite a number of the men at the Angus shops have obtained certificates of qualification certifying to their ability to give first aid in any kind of accident likely to occur in connection with their occupation. Instruction in "First Aid" gives a man an intelligent conception of the nature of his injury, and by reason of the spreading of this important knowledge the old custom of applying cobwebs, tobacco juice, greasy waste and other filthy

things to open wounds would not be allowed in any Canadian Pacific workshop. Ambulance instruction thus systematically organized means a saving of many lives, and much unnecessary suffering. It is the intention of the company to organize ambulance classes throughout its entire system.

The Railway Y. M. C. A.'s.—Another new building has recently been opened at Kenora, costing $30,000, to be devoted to special work for the railroad men. These buildings are given to the Y. M. C. A. to operate because of its unselfish purpose to be of service to railway men without financial gain. Boarding-houses had been erected by the company and given over to individuals, who made out of them what they could. This had not been altogether satisfactory, and now the company is trying an experiment with the Railway Department of the Y. M. C. A. The satisfactory working of one building at Revelstoke, B. C., during the past two years had induced the company to increase the number of points at which these buildings were established.

The general plan on which these buildings are operated is as follows:—The Railway Company makes a monthly appropriation sufficient to cover the salary of the secretary, in addition to providing light, heat, repairs, etc. The men pay a fee of $5, which covers use of baths, reading-room and general social privileges of the building. They pay $1.25 a week for a room and $4.50 a week for board. The operating of the building is in the hands of a local committee, composed for the most part of railway men.

Buildings have been opened at Schreiber and Chapleau, on the C. P. R. transcontinental line, in connection with the Railway Y. M. C. A. The buildings recently opened at these points each provide for forty-four men in the dormitories, and have a dining-room seating forty-eight, three bowling alleys in the basement, two billiard tables, reception room with large open fireplaces made of rough stones, bath-rooms, reading-rooms, smoking rooms, lockers, etc.

Comfortable Meals.—Napoleon said that an army travels on its stomach; a good comfortable meal for a workingman certainly means better work. Among the many special features at the mammoth Angus shops are the dining rooms for the men, which are unique in Canada. Good, wholesome, well-cooked food is served in warm, comfortable surroundings at very low prices. This service is possible because the company furnishes free buildings, light, etc. The system used is known as the "help yourself"—the men come in at one door, take a tray and pass along a counter, where they help themselves to what they desire as they pass to their seats. A ticket or check is placed by one of the attendants upon each tray, showing the price of the food they have selected. A full meal costs 19 cents, and an average meal about 15 cents. One thousand men can be comfortably seated at once in the two large dining-rooms.

Caring for the Men.—The company provides sleeping accommodation at every divisional point between the Atlantic and the Pacific, especially for the use of the engineers and firemen, for which no charge is made. These men, when at the end of their outward run, are sure of comfortable quarters in what are called "bunk houses." All of these kitchens have ranges attached by which the men can prepare their own meals, and at some of the more pretentious places, stewards are in charge, who furnish meals at nominal prices. Many of these "bunk houses" are supplied with railway papers, magazines and other literature. The sleeping and dining car department also provides sleeping accommodation for its porters at several points on the line.

For Mutual Protection.—As showing the hearty co-operation of the management and the men, the organization of a Safety League in Toronto—the first of its kind in the world—stands out as a splendid object lesson. The League consists of engineers, firemen, train, and yardmen, etc., and its purpose is the mutual protection of each other and the further safeguarding of the traveling public and the company's property by the strict enforcement of the standing rules and regulations. It is the duty of any member of this League who notices the violation of any rule by a brother employee to warn him of his neglect, and to report it to the League. The person named is compelled to accept the caution with thanks. The result is that the bulletins containing the violations bring to the attention of every member of the League the fact that certain rules are being disregarded, and this is having a marked effect in their close observance. As a matter of fact the infringements are of rules of minor importance, but the League's work is largely educational, and is proving beneficial to every one interested.

Pensions for Employees.—When the pension fund was created the following announcement was issued by the president of the Canadian Pacific Railway Co.:—

"The company feels that a time has arrived when some provision should be made for officers and permanent employees, who, after long years of faithful service, have reached an age when they are unequal to the further performance of their duties. With this object in view, the directors, with the approval of the shareholders, have, after a careful study of the question, determined upon a plan of superannuation, the particulars of which are set out in the accompanying rules and regulations.

"The system adopted calls for no contributions from the employees themselves.

"The company hopes, by thus voluntarily establishing a system under which a continued income will be assured to those who, after years of continuous service are, by age or infirmity, no longer able to perform their duties, and without which they might be left entirely without means of support, to build up amongst them a feeling of permanency in their employment, an enlarged interest in the company's welfare, and a desire to remain in and to devote their best efforts and attention to the company's service."

The rules and regulations are very simple and easily understood. It is specified that all officers and employees who have attained the age of sixty-five years shall be retired, and such of said officers and employees who have been ten years or longer in the company's service shall be pensioned.

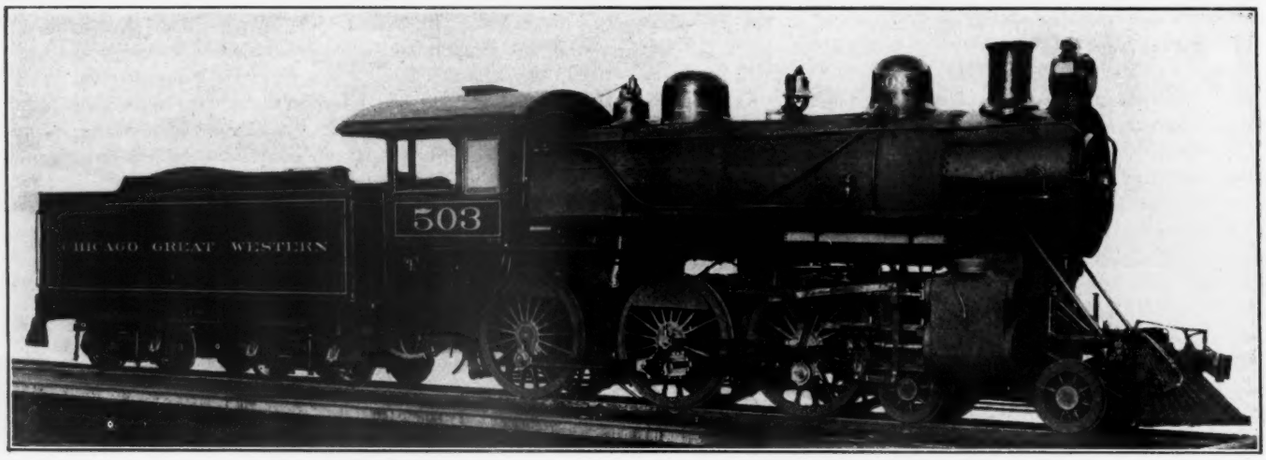
The pension allowance authorized shall be granted upon the following basis:—

"For each year of service an allowance of one per cent. of the average monthly pay received for the ten years preceding retirement, or preceding the date upon which the employee attained the age of sixty-five years, should he be retained in the service after such date; for example, an employee who has been in the service forty years, and received on an average for the last ten years sixty dollars per month, the pension allowance would be forty per cent. of sixty dollars, or twenty-four dollars per month." No pension allowance authorized, however, shall be less than twenty dollars per month.

In order that the direct personal relations between the company and its retired employees may be preserved, and that they may continue to enjoy the benefit of the pension system, no assignment of pensions will be permitted or recognized.

The acceptance of a pension allowance does not debar a retired employee from engaging in other business, but such retired employee cannot so engage in other business, nor re-enter the service of the company, except with the consent of the committee, without forfeiting his pension allowance. The number of persons over seventy years of age on the pension roll at January 1, 1909, was 105; between sixty and seventy years of age, 148; under sixty years of age, 23—total, 276 persons. The amount paid out for the year was $50,694.79, and the balance to the credit of the fund was $657,345.60.

MASKS FOR STREET SWEEPERS have been adopted by the Department of Street Cleaning, New York City, to prevent, as far as possible, the breathing of germ-laden dust. The mask is attached to the sweeper's hat and covers the lower part of his face, forming a screen over his mouth and nostrils. The commissioner of street cleaning is reported to have said that the sweepers have always been more subject to infectious diseases than any other men in the department, and that the breathing in of the dust raised by the brooms increases the danger of pulmonary diseases. In winter especially catarrhal troubles and influenza have been common.—*The Engineering Record.*



TEN-WHEEL PASSENGER LOCOMOTIVE WITH EMERSON SUPERHEATER—CHICAGO, GT. WESTERN RAILWAY.

TEN-WHEEL PASSENGER LOCOMOTIVE, WITH EMERSON SUPERHEATER, AND CONSOLIDATION LOCOMOTIVE.

CHICAGO, GREAT WESTERN RAILWAY.

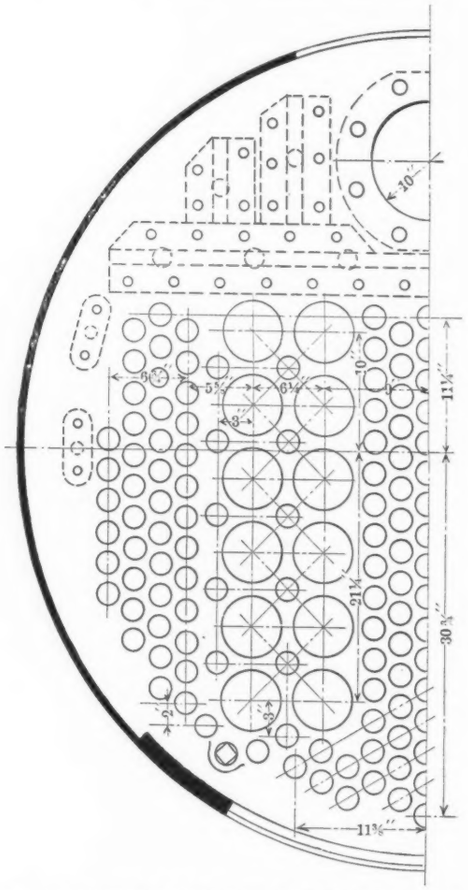
The Chicago, Great Western Railway has recently received twenty-four locomotives from the Baldwin Locomotive Works. Four of these are of the ten-wheel type for express passenger service; the remaining twenty are of the consolidation type for heavy freight service. Both designs follow the Harriman Lines standards in many respects, although important changes have been made in various details.

The passenger locomotives are of special interest, in that they are equipped with the Emerson type of fire-tube superheater. This device was first used on the Great Northern Railway, and the results so far have been reported as very satisfactory. In the Emerson type, the smoke-box headers approximate the usual steam pipes in form. Each header is divided into two compartments, one for saturated, and the other for superheated steam. The large boiler tubes, which accommodate the superheater elements, are placed immediately back of their corresponding headers, instead of being grouped in the upper part of the boiler barrel, as is usually the case with fire-tube superheaters. In the Chicago, Great Western locomotives the headers are straight, and stand vertically. The superheater elements on each side are placed in 12 tubes, arranged in two vertical rows of six tubes each. The superheated steam section of the header is centrally located between the two divisions of the saturated steam section, the latter being divided at the top. At the lower end, the superheated sections of the two headers are connected by an equalizing pipe. The superheater elements are composed of steel tubes having an internal diameter of 1 in. These tubes are expanded into the headers and are arranged with a double loop in each large boiler tube. The loops are connected by cast steel return bends. A plug is screwed into the front of the header opposite each tube opening. Application has been made for a patent covering this design.

The smoke-box contains a single high nozzle, and the stack is tapered, with a minimum internal diameter of 20 inches. An adjustable petticoat pipe extends downward from the stack base, and an adjustable diaphragm plate is located in front of the nozzle. The boiler has a straight top and a wide fire-box. The mud ring is 5 inches in width all around, so that liberal water spaces are provided. The crown sheet is flat, and is stayed by inverted T-bars hung on expansion links. The longitudinal barrel seams are butt-jointed, with "diamond" welt strips.

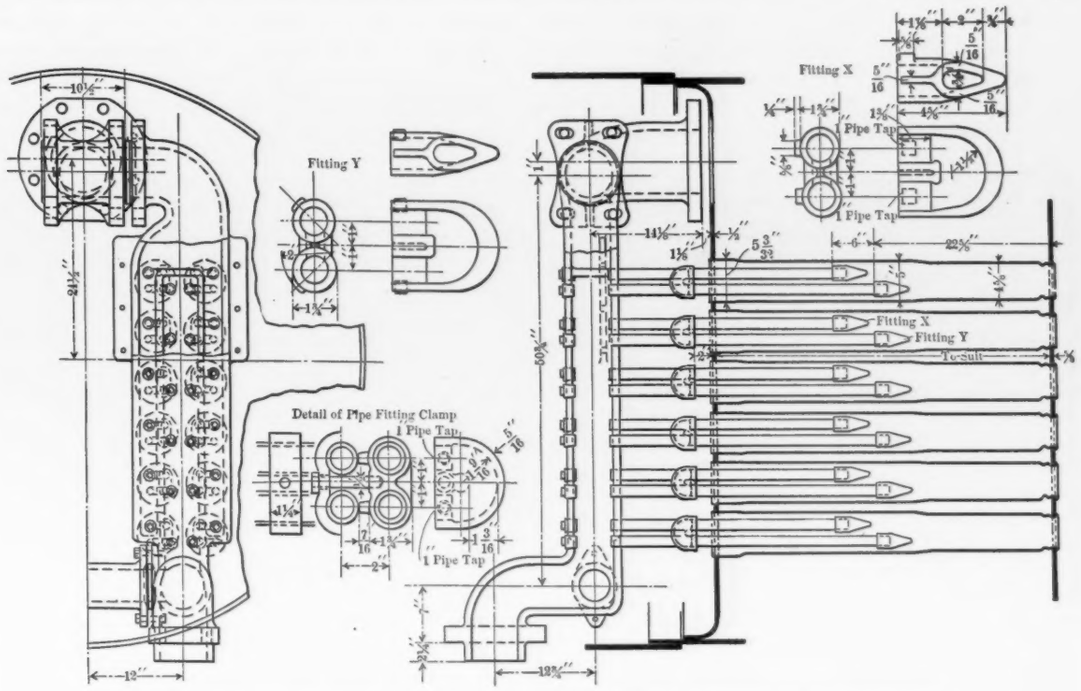
The safety valves are set at 150 pounds, and with cylinders 26 x 28 inches and driving wheels 73 inches in diameter, the resulting tractive force developed is 33,050 pounds. The cylinders are fitted with 13-inch piston valves, having cast iron bodies and three snap rings in each end. The cylinder castings are designed with heavy walls, and are secured to the smoke-box and to each other by a double row of bolts. The by-pass valves are similar to the well-known Pennsylvania Railroad design which has been extensively used by the builders. In the present instance the relief ports are covered by a flat plate of cast steel, made in one piece with a central spindle which acts as a guide.

The valve motion is of the Walschaert type, and presents a



SHOWING ARRANGEMENT OF SUPERHEATER TUBES.

simple arrangement of this form of gear. The link is mounted in a specially designed steel casting, which also serves as a support for the reverse shaft bearings. This casting is bolted at the front to the guide yoke, and at the back to a crosstie located between the first and second pairs of driving wheels. The combination lever is pinned directly to the valve rod, and the latter



EMERSON SUPERHEATER AS APPLIED TO CHICAGO, GREAT WESTERN 4-6-0 LOCOMOTIVE.

is supported by a suitable bracket mounted on the upper guide bar.

The consolidation locomotives use saturated steam at a pressure of 200 pounds. With 24" x 30" cylinders, and driving wheels 63 inches in diameter, the resulting tractive force is 46,600 pounds. The weight available for adhesion is thus utilized to the best possible advantage.

The steam distribution in these locomotives is controlled by balanced slide valves. The cylinders are arranged with their center lines coincident with the steam chest centers. Each combination lever is pinned to a long crosshead sliding in two brackets which are bolted to the top guide bar. This crosshead carries a lug to which the valve rod is secured. In this way the motion is transferred from the plane of the link to that of the steam chest center, without the use of a rocker. The boilers of these engines are straight top, with crown-bar stays, and as far as construction is concerned, follow Harriman Lines practice closely.

The tenders of both classes are similar, and are mounted on arch-bar trucks having steel bolsters and "Standard" rolled steel wheels. The longitudinal sills are 12-inch steel channels.

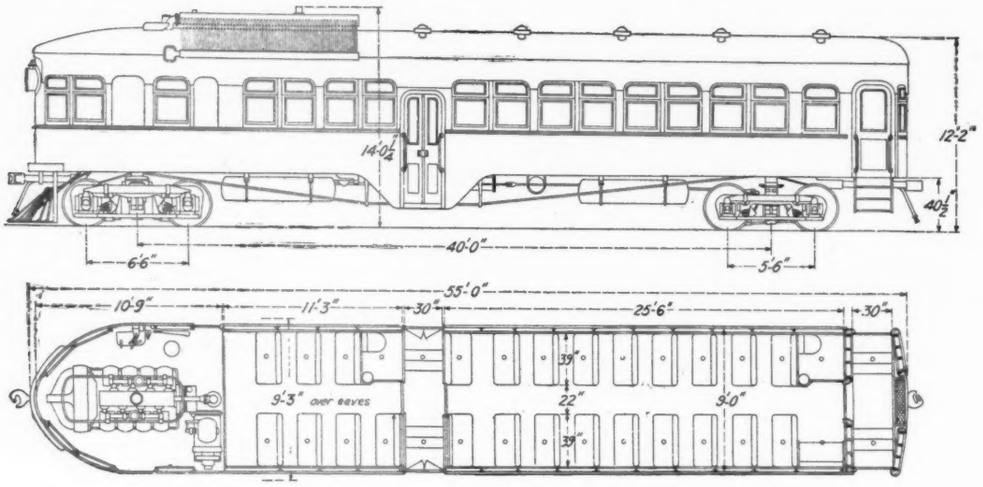
The principal dimensions of both classes of locomotives are as follows:

	Ten-Wheel.	Consolidation.
GENERAL DATA.		
Gauge	4 ft. 8½ in.	4 ft. 8½ in.
Service	Passenger	Freight.
Fuel	Soft coal	Soft coal.
Tractive effort	33,050 lbs.	46,600 lbs.
Weight in working order	198,050 lbs.	216,000 lbs.
Weight on drivers	144,950 lbs.	187,000 lbs.
Weight on leading truck	53,100 lbs.	29,000 lbs.
Weight of eng. and tender in working order	343,000 lbs.	360,000 lbs.
Wheel base, driving	15 ft.	17 ft.
Wheel base, total	27 ft. 1 in.	25 ft. 8 in.
Wheel base, engine and tender	57 ft. 9½ in.	58 ft. 6 in.
RATIOS.		
Weight on drivers ÷ tractive effort	4.38	4.01
Total weight ÷ tractive effort	5.99	4.63
Tractive effort × diam. drivers ÷ heating surface	1024	796
Tractive effort × diam. drivers ÷ equiv. htg. surface*	.792	
Total heating surface ÷ grate area	47.5	74.3
Equiv. heating surface* ÷ grate area	61.5	
Tube heating surface ÷ firebox heating surface	14.8	20.5
Weight on drivers ÷ total heating surface	61.5	50.7
Weight on drivers ÷ equiv. heating surface*	47.6	
Total weight ÷ total heating surface	81.1	58.6
Total weight ÷ equiv. heating surface	64.0	
Volume both cylinders	17.2 cu. ft.	15.6
Total heating surface ÷ vol. cylinders	136.9	236.2
Superheater surface ÷ vol. cylinders	26.7	
Grate area ÷ vol. cylinders	2.88	3.18
Equiv. heating surface* ÷ vol. cylinders	177.0	
CYLINDERS.		
Diameter and stroke	26 x 28 in.	24 x 30 in.
VALVES.		
Kind	Bal. piston	Balanced slide.
WHEELS.		
Driving, diameter over tires	73 in.	63 in.
Driving, thickness of tires	3½ in.	3½ in.
Driving journals, main, diameter and length	10½ x 12 in.	10½ x 12 in.
Driving journals, others, diameter and length	9 x 12 in.	9 x 12 in.
Engine truck wheels, diameter	33½ in.	33 in.
Engine truck journals	6 x 10 in.	6 x 10 in.
BOILER.		
Style	Straight	Straight.
Working pressure	150 lbs.	200 lbs.
Outside diameter of first ring	70 in.	80 in.
Firebox, length and width	107 15/16 x 66½ in.	108 1/16 x 66⅝ in.
Firebox plates, thickness	S. & B.5/16, C. ⅜, T. ⅝ in.	5/16, ⅜, ½ in.
Firebox, water space	5 in.	5 in.
Tubes, number and outside diameter	24, 5 in.—203, 2 in.	413, 2 in.
Tubes, length	16 ft.	16 ft. 4 in.
Heating surface, tubes	2,206 sq. ft.	3,514 sq. ft.
Heating surface, firebox	149 sq. ft.	171 sq. ft.
Heating surface, total	2,355 sq. ft.	3,685 sq. ft.
Superheater heating surface	460 sq. ft.	
Grate area	49.5 sq. ft.	49.6 sq. ft.
TENDER.		
Wheels, diameter	36 in.	33 in.
Journals, diameter and length	5½ x 10 in.	5½ x 10 in.
Water capacity	8,000 gals.	8,000 gals.
Coal capacity	11 tons.	11 tons.

* Equivalent heating surface equals evaporating heating surface (2,355 sq. ft.) + 1.5 times the superheater heating surface (460 sq. ft.) = 3,045 sq. ft.

OIL ALLOWANCE AND COAL CONSUMPTION.—It has been the fashion of many roads for a number of years past to economize on the oil supply for locomotives to such an extent as to create more friction between moving surfaces in contact than there would be if proper amount of lubricants were used, also cutting frictional surfaces. This has resulted in locomotives burning more coal than they would otherwise, and lying down with their tonnage rating at times, when, if properly lubricated, they would have handled it. This is a case of spending dollars in trying to save cents. The matter of oil allowance should be left entirely to a practical man who is directly in charge of men and engines, to be handled by him regardless of the prevailing fashion.—*C. F. Smith, St. Louis Railroad Club.*

RELIGHTING ARC LAMPS.—Arc lamps should not be relighted immediately after they have been extinguished, unless it is absolutely necessary; an explosive mixture often exists in the globe a few moments after the light is extinguished, due to the mixture of gas and air. The writer has noted several instances in which every inner globe on the circuit has been shattered from this cause.—*R. H. Fenkhausen in Power and The Engineer.*



PLAN AND ELEVATION OF MOTOR CAR FOR SOUTHERN RAILWAY.

GAS-ELECTRIC MOTOR CAR.

SOUTHERN RAILWAY.

A brief description of the gas-electric motor cars recently purchased by the Southern Railway Company from the General Electric Company, and now under construction, may prove of interest to the many steam railroads which operate similar service. These cars have been designed with special reference to traffic conditions in the south. The car is divided by a center entrance. The seating capacity forward of this is 14, and to the rear is 38, making a total of 52. A rear entrance is also provided, thus completely dividing the forward and rear passenger compartments.

The car body is 55 ft. long over bumpers; of this space the engine compartment will take up 10 ft. 9 in., leaving the balance for passengers and platforms. It will have a steel frame and will be sheathed with steel plates, the interior trim being of mahogany. The truck under the engine compartment will have a wheel base of 6 ft. 6 in., and will be equipped with M. C. B. 33-in. steel wheels. On each axle will be mounted a standard 100 h.p. 600-volt box frame, commutating pole, railway motor, type GE-205, thus giving the car a motor capacity of 200 h.p. The rear truck will have a wheel base of 5 ft. 6 in.

In the engine compartment will be a direct driven gas engine generator set, the engine being of the 8-cylinder "V" type, each cylinder being 8 in. in diameter and having an 8-in. stroke. Direct coupled to the engine will be an 8-pole 600-volt generator provided with commutating poles. This set will be mounted on a cast iron base, and all parts will be above the floor line and readily accessible. Current from the generator will be supplied to the motors through a controller, the function of which is to place the motors progressively in series and parallel, and to vary the resistance in the shunt field of the generator by means of numerous steps, thereby varying the impressed voltage on the motors. The engine ignition is furnished by a low tension magneto and magnetic spark plugs. The carburetor is of the overflow type, and is hot water jacketed. Compressed air is used for starting the engine, this being supplied to the several cylinders in succession through a distributing valve. Compressed air is supplied from a pump direct driven by the main crank shaft. A small auxiliary gas-engine will drive an auxiliary pump to supply compressed air to the main reservoirs when necessary. This gas-engine is also direct connected to a generator for lighting the car.

Combined straight and automatic air brakes will be furnished, together with the usual auxiliary apparatus, and in addition to these brakes an auxiliary ratchet and hand brake is part of the equipment for emergency use. A radiator is placed on the roof of the car which provides an efficient means of cooling the engine on the thermo-siphon principle. During cold weather, hot water from the engine circulating system will be by-passed through the passenger compartments.

Although these cars can be geared for a speed of about 60 miles an hour on tangent level track, such speeds are not usually required on branch line service, and the Southern Railway cars will be geared for a somewhat lower maximum speed.

The ease of control and smoothness of acceleration are prominent features of this type of equipment, and are secured solely by reason of the gas-electric drive principle which it embodies. As there is no mechanical transmission between the engine and the axle, the speed of the engine is not a function of the speed of the car; consequently, the gas-engine may be operated so as to give its maximum output irrespective of the speed of the car —a characteristic which is of great value in case of emergency or heavy work. It has been found that the electrical equipment, consisting of the generator, controller and motors, and which takes the place of the gears, chains, sprockets, clutches and other mechanical means of transmitting the power of the gas-engine to the axle, is subject to very little maintenance expense, and the efficiency of this electric drive is high. The feature, perhaps, which will most strongly appeal to railway men is the simplicity of this control, and the ease and certainty with which it can be handled by an ordinary unskilled operator.

VARIATIONS IN PASSENGER CAR PAINTING PRACTICE

The rather remarkable variations that exist in car painting practice—remarkable considering the amounts of money involved, and the need of saving some of the present huge paint outlay—are presented in a paper read before the recent convention of the American Chemical Society by Carl F. Woods, of the Arthur D. Litttle, Inc., laboratory of engineering chemistry, in Boston.

As a sign of the present unscientific way of dealing with paint problems, Mr. Woods notes at the outset that although there has been in recent years a strong movement for the standardization of paint products, very little attention is being given to the proper application of the standardized paints themselves.

There is no class of painting in which this is more clearly illustrated than in that of car finishing, for this is not a comparatively simple operation like house painting, but on the contrary is a complex and highly skillful procedure, requiring expert labor and involving the application of many coatings.

The object of car painting is both for protection and for decoration, although the latter consideration has exerted the greater influence on the modern practice of car finishing. It is possible to preserve the woodwork of a car body just as efficiently by frequent painting with suitable oil paints as by covering

it with the ten to fifteen coats of paint and varnish customarily applied. The steam or electric car operated on the surface, however, occupies a prominent position, and the public justly demands that it present a well kept exterior.

The cost of painting the same type of car varies on different roads from $30 to $60, and in certain cases an even larger amount. Some roads are forced to repaint their cars every two years, and others with the aid of one coat of varnish each year are able to operate for ten to fifteen years before complete refinishing becomes necessary. It is particulary significant that those cars that have had the most expensive finishing are not of necessity the longest lived. It is obvious, therefore, that there are certain underlying principles upon which the durability of the finish depends.

Car paints as a rule are mixtures of liquids and solids having widely different chemical and physical properties. While each succeeding treatment has its own specific demands, the entire paint coating must amalgamate and act as a unit to prevent separation of the various films under the physical stresses of service, produced by the expansion and contraction of the car under changes of temperature, and the wrenching and twisting incidental to operation.

There are four fundamental operations in car painting which must be performed to obtain the proper finish and the desired durability:

First, the pores of the wood must be thoroughly saturated to prevent the absorption of succeeding coats and to form a cementing bond between the wood and the paint films.

Second, the natural inequalities of the surface must be corrected and a smooth, hard foundation prepared for the application of the succeeding color and varnish coats.

Third, the required color must be applied in a smooth, homogeneous film which is sufficiently thick to cover the underlying coats and which at the same time possesses proper elasticity.

Fourth, the color coat must be covered with a film of varnish, both to protect the underlying paints from the effect of the weather and to obtain the glossy, smooth finish desired. It is necessary that this final coat be hard enough to withstand the abrasive action of sand and dirt and the general deteriorating effects of sun, wind and weather, but at the same time possess the maximum amount of elasticity.

Three distinct processes for car finishing are in use. These three systems may be called the "lead and oil," the "surfacer" and the "color and varnish" processes. Other methods of finishing are employed, but all of them are abbreviations or combinations of the three main types.

The "lead and oil" process, the oldest system in use, consists in thoroughly saturating the wood with a thin paint of white lead and linseed oil, followed after proper drying by thicker coats of the same paint until the wood work is properly "primed and filled." On the foundation so prepared several coats (usually three) of a special paint known as "rough stuff," are applied. This consists essentially of a mineral silicate of moderate fineness mixed with white lead and ground in varnish. Such a paint dries quickly and can be brought, by rubbing with blocks of pumice, to a smooth, slate-like finish, which affords an admirable surface for the body color. After a sufficient amount of color has been applied, the entire surface is given several coats of varnish, allowing each to dry thoroughly before adding the next.

The "surfacer" process was devised about thirty years ago to reduce the time, labor and expense of the old "lead and oil" system. The fundamental difference between the two processes is that the "surfacer" system omits the lead priming and filling and the "rough stuff" coats, but builds up the surface rapidly by the application of specially prepared paints. After the building-up coats have been laid, the entire surface is rubbed with block pumice to the desired finish. From this point on, the process is identical with the "lead and oil" system, the "surfacer" process confining its efforts to the rapid preparation of a surface for the color coat.

The "color and varnish" process is of very recent origin and is a radical departure from the older "lead and oil" and "surfacer" systems. The fundamental idea of the new process is that the fewer the number of coats and the more similar these coats are in composition, the more durable will be the final results obtained. With this in view, a combination of coats is applied which are so composed as to prime the wood, prepare a surface, and obtain the desired color at the same time. This is accomplished by employing heavy silicate paints, containing the proper color ground in the same kind of varnish, each coat possessing suitable drying qualities for its respective demands. The best results are obtained by the use of dark colors, such as green or brown, because the principal ingredient may be ochre, umber or some other natural earth pigment which not only produces the desired shade, but is well adapted for preparing a foundation. The surface so obtained is covered with a coat of the body color ground in varnish, followed by one thick coat of finishing varnish.

Each of the processes referred to has its specific faults and virtues. The "lead and oil" process, if properly applied, requires from three to four weeks and the application of ten or more coats. The "surfacer" process requires about the same number of coats, but, owing to the quicker drying of the surfacers, requires but two to three weeks for application. The "color and varnish" process is the simplest of all, and has been applied with apparently successful results in from six to eight days, with an application of four to six coats.

The faults of the "color and varnish" process are not as yet thoroughly understood, as the method is of very recent development and has not been subjected to the test of long continued service. It should be understood that the aim of this shorter process is durability at the lowest cost, and that appearance is in a measure sacrificed; but it is claimed that the finish obtained is fully as durable as by the older methods, that it is free from many of their faults, and that it produces a finished appearance sufficiently good for the purpose. On the other hand, the process is dependent upon specially made paints in which adulteration is difficult of detection, and which if carelessly made are not only short lived, but render more difficult the refinishing of the car. The system is only applicable to dark colors, as the lighter and more brilliant pigments do not possess sufficient covering power, but this is not in itself a failing, as the use of dark green and brown colors is rapidly increasing, owing to the greater stability and length of life obtained. In this connection it is of interest to note that the Pullman Company have adopted a brown body color as the most satisfactory shade available, while a large proportion of the railroads, both steam and electric, employ a color of similar nature.

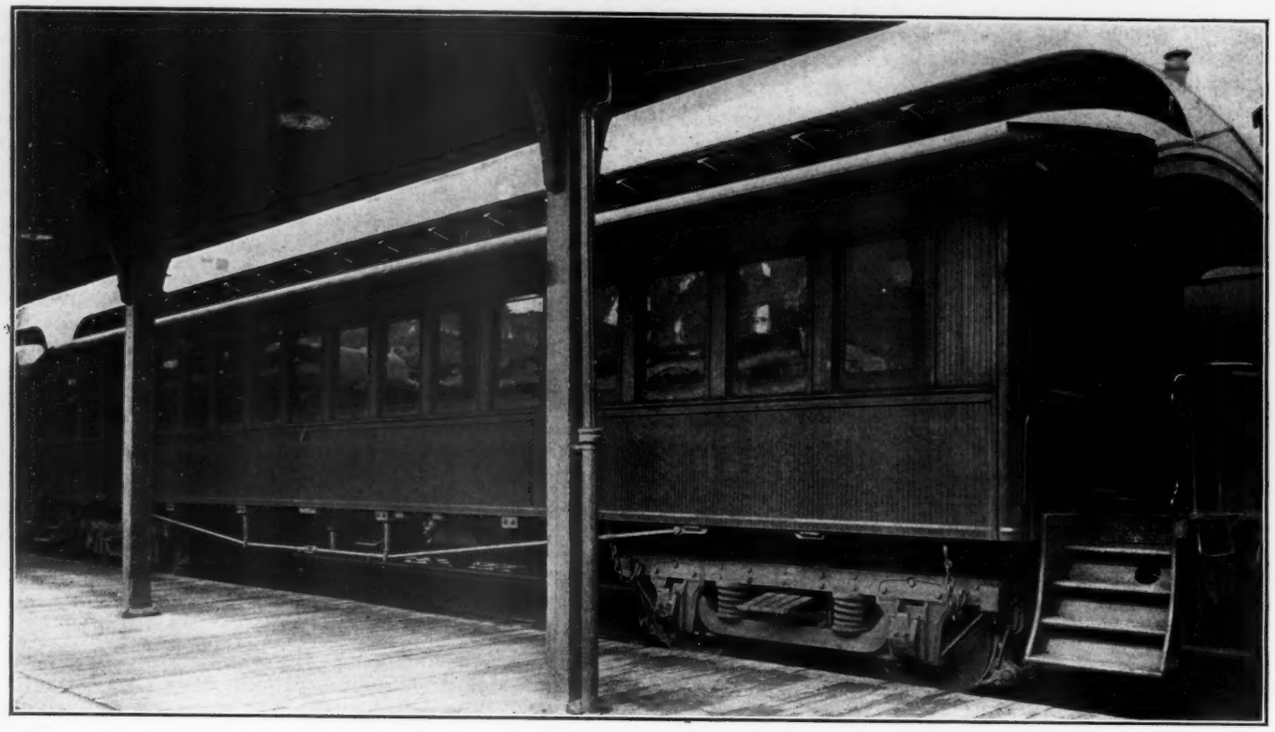
It has been shown by actual results that a saving of $20 to $30 can be made on the painting of each car and an increase in life obtained of from 5 to 10 years by the adoption of scientific methods of finishing. It is probable that no one of the methods in use embodies the maximum efficiency possible of attainment, and in view of the very large amount of money involved it is desirable that the entire subject be given careful study by technical chemists.

CARS AND LOCOMOTIVES ORDERED DURING 1909

Statistics compiled by *The Railway & Engineering Review* show that 3,233 locomotives, 185,445 freight cars, and 3,980 passenger cars were ordered during the year. This is very near the total of locomotives ordered in 1907, which was 3,482; but very much less than 1906, 5,642, and 1905, 6,265. The addition to tractive effort is not, however, clearly indicated by these figures, as the size and capacity of locomotives continues to increase.

3,980 passenger cars were ordered in 1909 as against 1,319 in 1908; 1,791 in 1907; 3,402 in 1906, and 3,289 in 1905.

185,445 freight cars of all kinds were ordered in 1909 as against 62,669 in 1908; 151,711 in 1907; 310,315 in 1906, and 341,315 in 1905, which was the largest year.

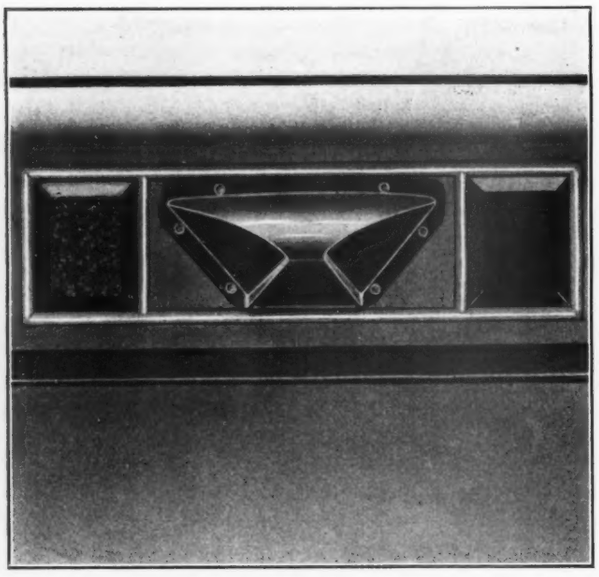


PASSENGER COACH WITH WARD EQUIPMENT COMPANY VENTILATORS.

PASSENGER CAR VENTILATOR.

As the result of a great deal of experimenting under actual service conditions, and extending over a considerable period of time, a passenger car ventilator has been developed by the Ward Equipment Company, of New York City, which is said to give practically ideal results. As a matter of fact, several cars equipped with this ventilator and operating under very severe conditions, as concerns ventilation, have been running for over a year with splendid results.

Some idea of the construction and application of the ventilator



SHOWING APPLICATION OF VENTILATOR.

may be gained from the accompanying photographs. It is made in one piece and is of cast iron, so that it will not corrode when subjected to weather conditions, gases from coal, etc. The construction of the ventilator, with the sloping top and sides and the design at the bottom of the sides, is such that the air striking it is deflected downward, inducing a current of air from inside the car. An idea of the rapidity with which the air may be changed in the car may be gained from the fact that a smoking car filled with smoke may be cleared in from three to four minutes. Having a ventilator on every sash insures uniform ventilation throughout the car.

The design is such that cross winds are deflected and there are no down drafts on the heads of the passengers. It is impossible for rain, snow, cinders, dirt or dust to find their way into the car through the ventilators. Cars equipped with these ventilators have been used on runs through long tunnels where the traffic is very heavy; it was possible to leave all of the drop sashes in the car wide open without smoke or gases entering the car.

In applying the ventilator the drop sash is not disturbed and no change is necessary in the construction of the car. It is thus possible to apply it, if necessary, while the car is standing in the yards or in the terminal between runs. A small light of glass is placed on each side of the ventilator, thus increasing the volume of light in the clear-story and throughout the car. The wire gauze is done away with; this is very expensive to maintain because of rapid corrosion and is not very effective because of the holes becoming filled up with dust or dirt.

SELF-CLEARING ASH PANS.—The reports received by the *Block Signal and Train Control Board* up to November 1, 1909, cover a total of 50,879 locomotives. Of this number 26,336 are equipped with pans that are designed to meet the requirements of the law. The reports indicate that a further number of 19,676 locomotives are expected to be properly equipped before January 1, 1910. Of the total number of engines reported, 2,813 come under the exception in Section 6 of the law as not requiring ash pans, and 25 are to be retired from service before the end of the year. This leaves 2,029 locomotives, of the total number reported, which apparently remain to be equipped after January 1, 1910.

RECEIVERSHIPS IN 1909.—According to the *Railway Age Gazette* the number of steam roads that went into the hands of receivers in 1909 was 5; their aggregate mileage, 859; their stock, $30,549,000; their funded debt, $47,546,000; and their total capitalization, $78,095,000.

HEAVY CONSOLIDATION LOCOMOTIVE.

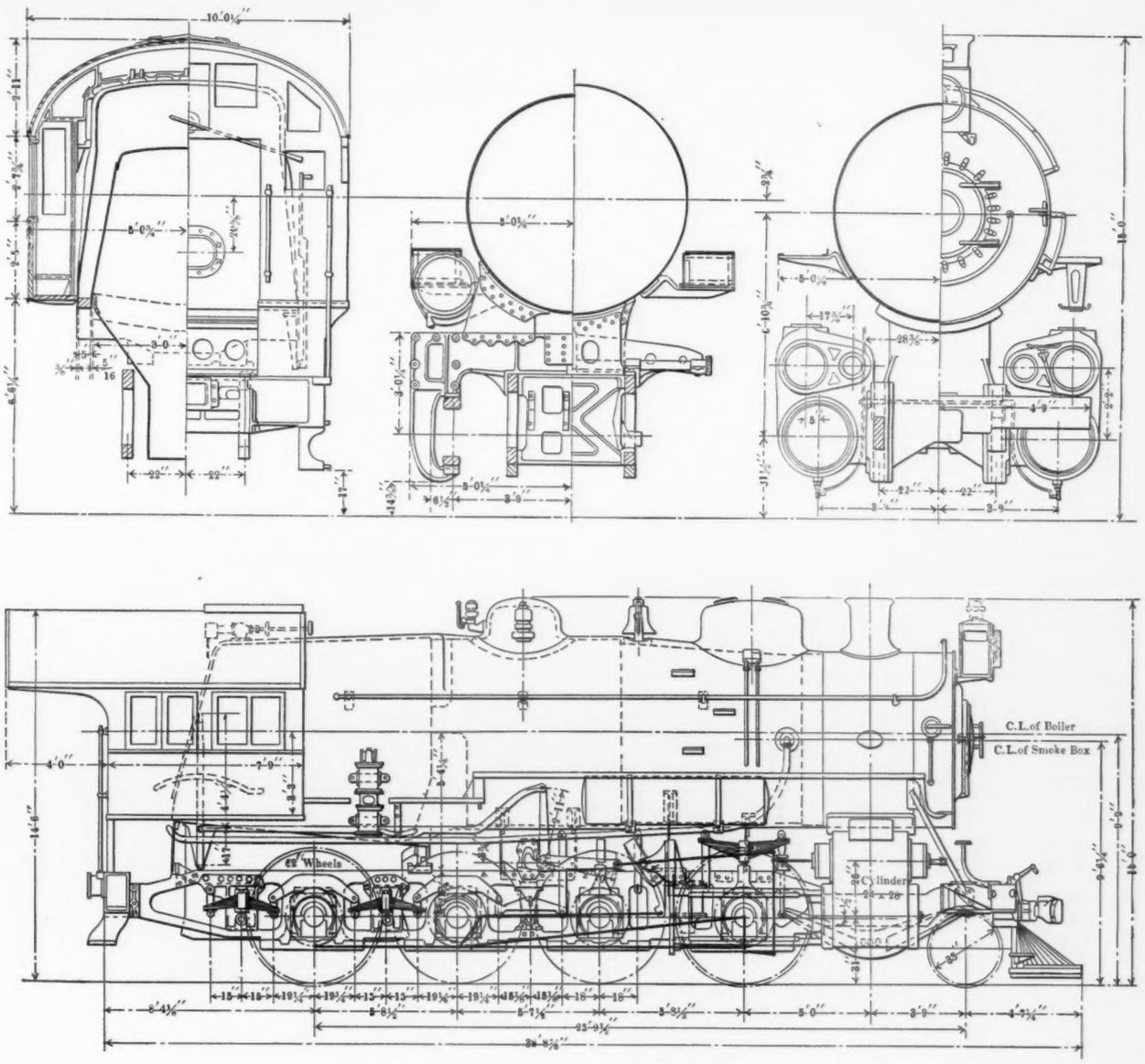
PENNSYLVANIA RAILROAD.

What is said to be the heaviest freight train ever hauled by one locomotive in this country, and probably in the world, was moved over the Pennsylvania Railroad between Altoona and Elona, Pa., on June 22, 1909, when locomotive No. 1113 pulled a train of 105 steel coal cars, loaded with 5,544 tons of coal, for a distance of 127 miles in seven hours and twelve minutes, or an average speed of 17.6 miles per hour.* The maximum grade over this section of the road is but 12 ft. to the mile. The total weight of the train, including engine, tender and caboose, was 7,644 tons, and the weight of the train behind the tender about 7,453 tons. The train was about 3,600 ft. long.

The locomotive that made this record was built at the Juniata shops of the Pennsylvania Railroad, and is one of what is known as class H8b. It was designed in the mechanical engineer's office at Altoona and is an excellent example of a very powerful consolidation engine equipped with drivers which permit moderately high speed and with sufficient heating surface to make such speeds, as for instance, 20 miles per hour, attainable for long distances at practically full tractive effort. A factor of adhesion of nearly five was adopted in order to be assured that the full power of the engine could be delivered even under difficult rail condiitons. A high factor of safety in a freight locomotive is also of great benefit in starting a heavy train out of the yards without the assistance of a pusher.

The illustrations show a number of the more interesting features of this locomotive. Possibly the most prominent impres-

* This record is claimed to have since been exceeded by a train on the Virginian Railway.



HEAVY CONSOLIDATION LOCOMOTIVE CLASS H8B—PENNSYLVANIA RAILROAD.

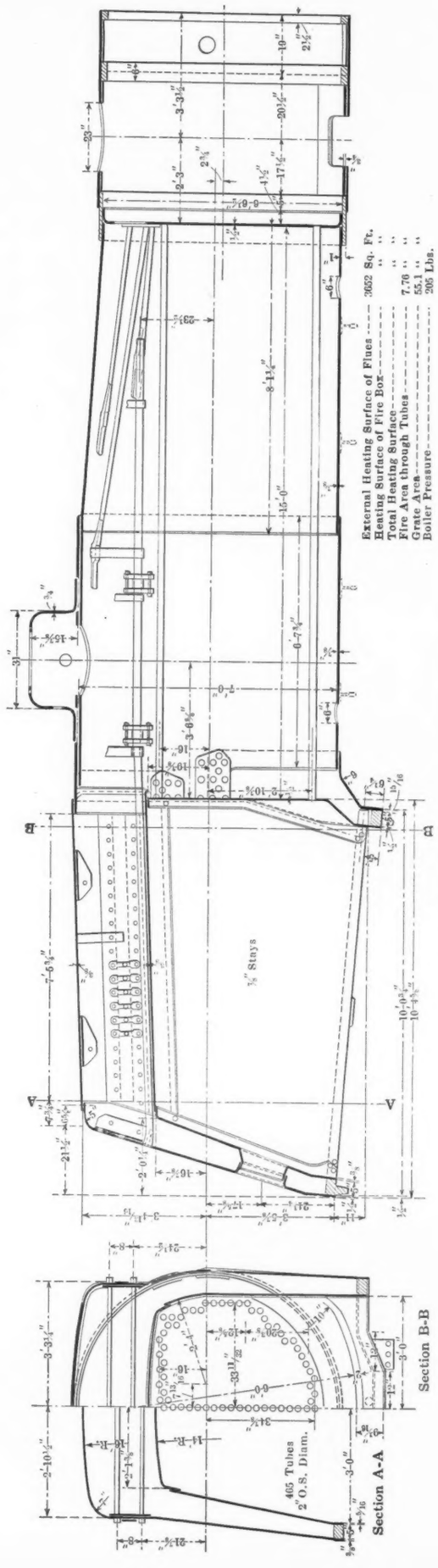
sion given by a general examination of them is that of massiveness. Because of the large power to be developed there was no occasion to save weight at any point, as great weight would be needed for adhesion, and as a result massive steel castings, of undoubted strength, are found at every point where weakness might occur. This feature is particularly noticeable in the bracing of the frames, which is unusually well taken care of.

Boiler.—A boiler of sufficient capacity is, of course, the most important feature of the design of a locomotive intended for what might be termed "capacity" work on a railroad, either freight or passenger. A study of the boiler drawing and of the table of heating surfaces and ratios shows that this feature was well recognized and had been given careful study. The design of the boiler, however, must necessarily be dependent to a considerable extent on the fuel available and while with the fuel conditions of some roads this boiler would probably not give the full locomotive capacity at 20 miles per hour, under the proper conditions is undoubtedly will do so and in fact service tests of long duration have demonstrated this. The shell has but two courses, the front one being the conical course, measuring 78½ in. outside diameter at the front end and 84 in. at the back end, the sheet being 8 ft. 1¼ in. in length. The second course is of uniform diameter and is 7 ft. 2¼ in. in length; it is in the center of this course that the dome is located. The design of the dome is somewhat unusual; it is made of ¾ in. steel plate pressed into shape; its outside diameter is 31 in. and its height above the shell 15⅞ in.

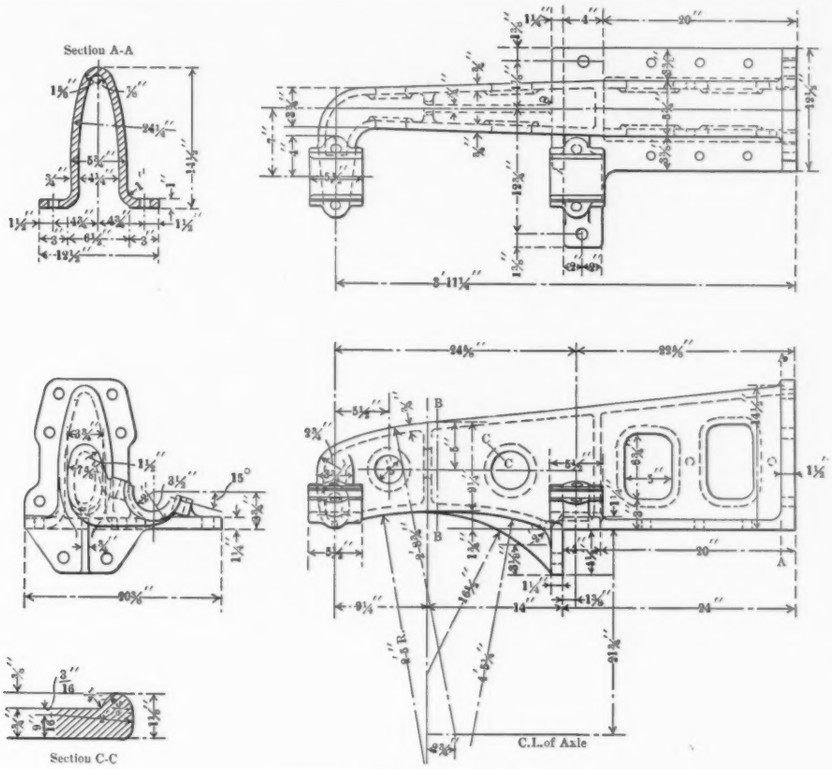
The firebox is of the customary Pennsylvania Belpaire type with a 5 in. mud ring. The side sheets, both inner and outer, are straight at the back and bellied out to fit the shape of the shell at the forward end. The back tube sheet is set in some distance from the face of the mud ring, as is shown in the longitudinal section. The boiler illustration shows the location of the interior feed pipe, which connects to the double check valve on the back head of the boiler and discharges at a point about 3 ft. back of the front tube sheet and above the top of the tubes. This pipe is about 4 in. higher at the front than at the back end, so that it drains toward the check valve. The tubes are but 15 ft. in length, but number 465, giving a heating surface of 3,652 sq. ft.

Frames.—The frames are of wrought iron or cast steel in two sections, the connection being between the first and second pedestals at a point directly beneath the guide yoke. They are normally 4 in. in width and measure 8 in. in depth over the pedestals, and at other points from 4 to 7 in. on the various rails. They are forged to include the seats for the vertical keys holding the saddle and cylinder castings, both front and rear. The front section of the frame extends continuous to the bumper beam. The frame bracing, as above mentioned, is ample, the principal braces being a broad steel casting placed horizontally across the frames above the first pedestal; a heavy vertical frame brace just beneath the guide yoke, which supports the brake cylinders; a heavy brace, across between the second and third pedestals, consisting of a horizontal steel casting over 30 in. in width, below which is a substantial casting placed vertically and connecting to all four rails, this being also bolted to the horizontal brace; also, just back of the third pedestal is a brace which supports the forward end of the mud ring. The frames are secured to the boiler between the cylinders and the front mud ring by four belly braces. The front bumper beam is also most substantial, consisting of three steel castings, one between the frames, including the guide for the truck pin, and two outside the frames for wing castings. None of these are fastened to the cylinders. A similar design is found at the tail casting, which is in three parts, all being arranged to lip over the frames at the top, where they are secured together. The arrangement of the spring rigging and equalizers is clearly shown in the illustrations.

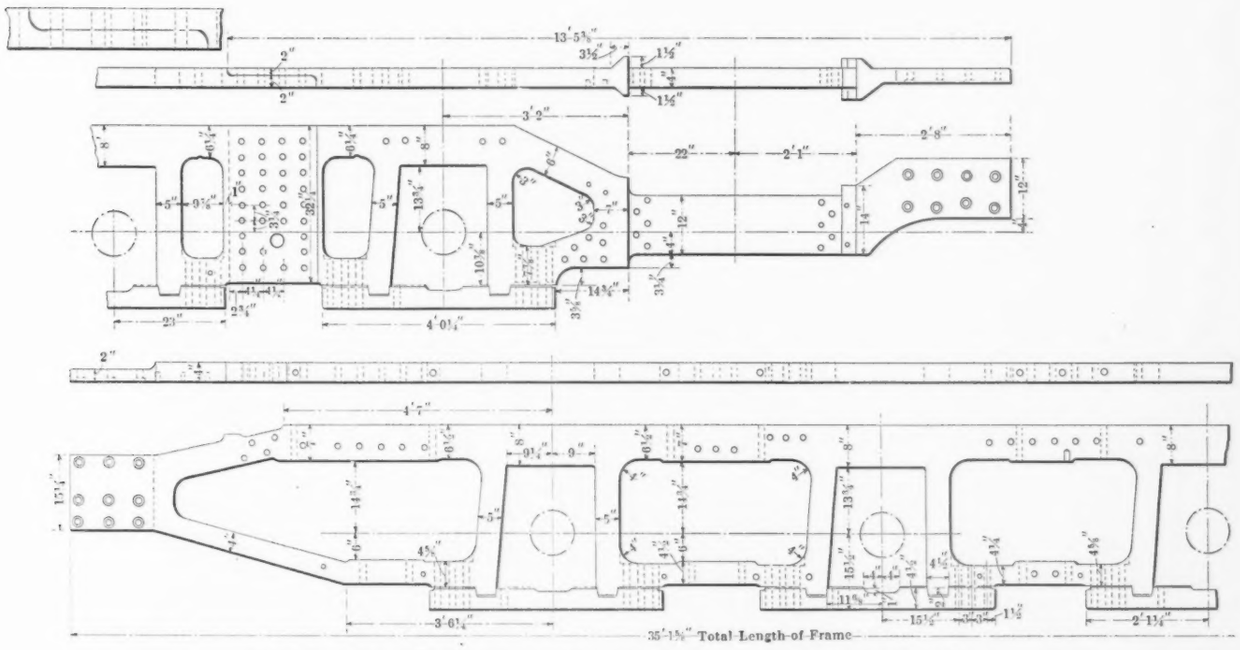
Guide Yoke.—The guide yoke is formed of two duplicate steel castings, joined on the center line. It is securely fastened to the frames by both vertical and horizontal bolts and is also



BOILER OF CLASS H8B LOCOMOTIVE—PENNSYLVANIA RAILROAD.



SUPPORT FOR REVERSE SHAFT.

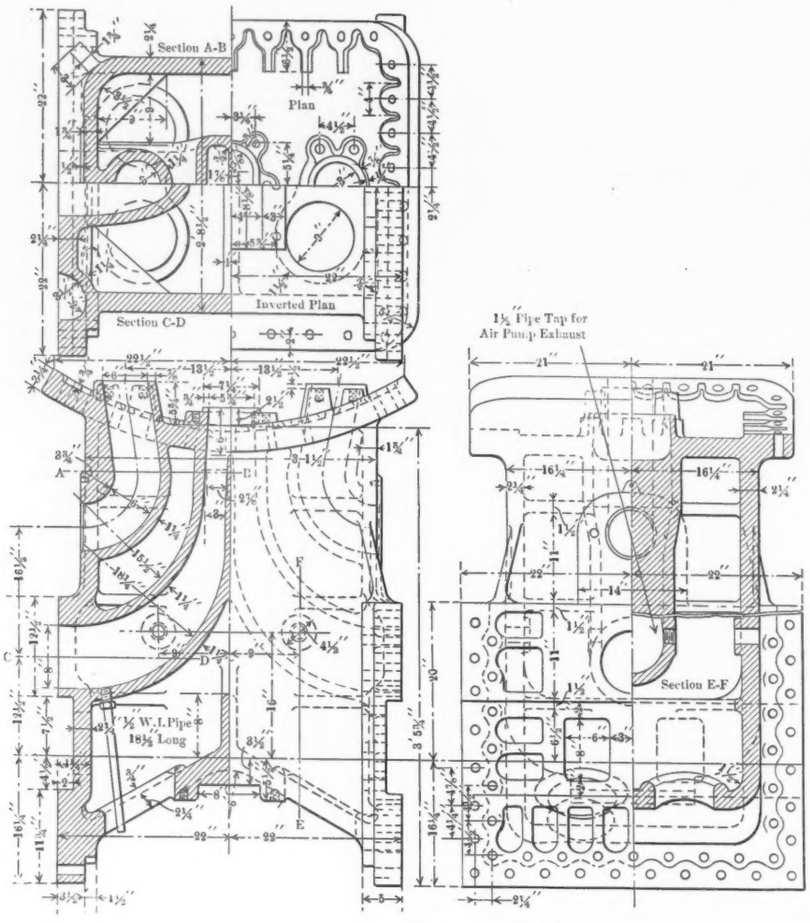


FRAMES—CLASS H8B CONSOLIDATION LOCOMOTIVE—PENNSYLVANIA RAILROAD.

bolted to the vertical frame brace. The bearing for the link trunnions is secured to the outer end of the yoke, as is shown in the illustration.

Reverse Shaft Support.—An interesting design in cast steel is found in the support for the reverse shaft located on top of the frame between the second and third drivers. This has an extension outside the frames and carries a bearing for the outer end of the reverse shaft, the arm of which connects to the radius bar of the valve gear through a slip joint. This support, in section, is in the shape of an inverted U, giving great stiffness without excessive weight.

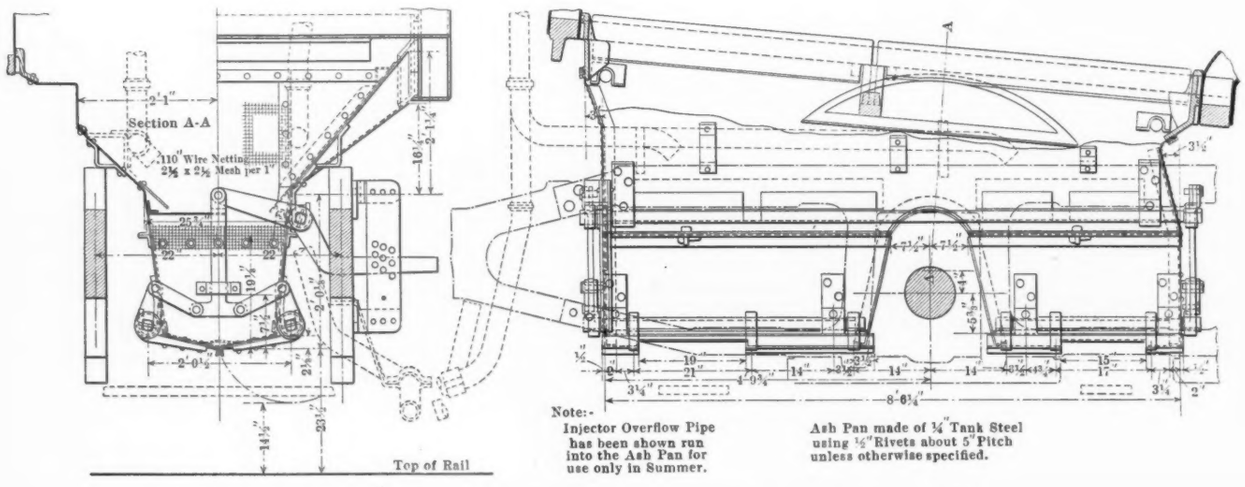
Cylinders.—As is customary on the Pennsylvania Railroad, the cylinders are cast separate from the saddle. The saddle casting in this case has a passage which conveys the steam from the steam pipes and emerges in the center just above the frames, where it is continued by a short steam pipe with a slip joint connecting to the center of the valve chamber. The exhaust passage in the saddle is single and connects to its continuation in the cylinder casting directly, without the use of an extra pipe. In the cylinder casting the exhaust passage divides and emerges front and back just back of the valve chamber. The valve chamber heads are specially designed to connect and furnish the passage for the exhaust steam from the end of the valve chamber to this passage in the cylinders. In this manner the castings for both cylinders and saddle are very much simplified and are capable of being designed with greater assurance than is pos-



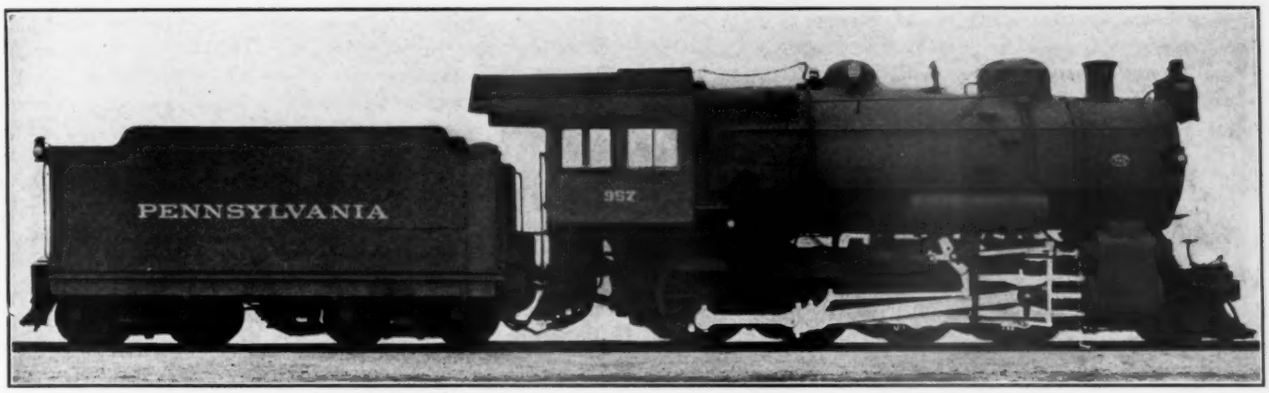
SADDLE CASTING—CLASS H8B LOCOMOTIVE.

sible where the passages are all contained in one casting. The illustrations show the details. The frames are in slab form 12 in. in depth, where they pass between the cylinders and saddle and are set into recesses in both of these castings, which are secured together above and below as well as through the frames.

Valve Gear.—A design of Walschaert valve gear, which is all in one vertical plane has been permitted by setting the valve chamber 5 in. outside the center line of the cylinders. The valve gear is a very straightforward simple arrangement. The valve stem connects to a crosshead supported by a bracket set on top of the guides, to which is also connected the combination lever. The link is supported back of the guide yoke, and its lower extension at the connection for the eccentric rod has a lever arm of 24½ in., bringing this point almost to the center line of the drivers. The path of the pin on the return crank, or double the amount of eccentricity, is 22¾ in. and the length of the eccentric rod is such that the bottom of the link swings farther back than forward of the vertical center line dropped from its trunnion, in order to improve the steam distribution. The reversing is done through a slip joint on the radius bar, which extends back of the link, the arm on the reversing shaft being 2 ft. 10 in. in length.

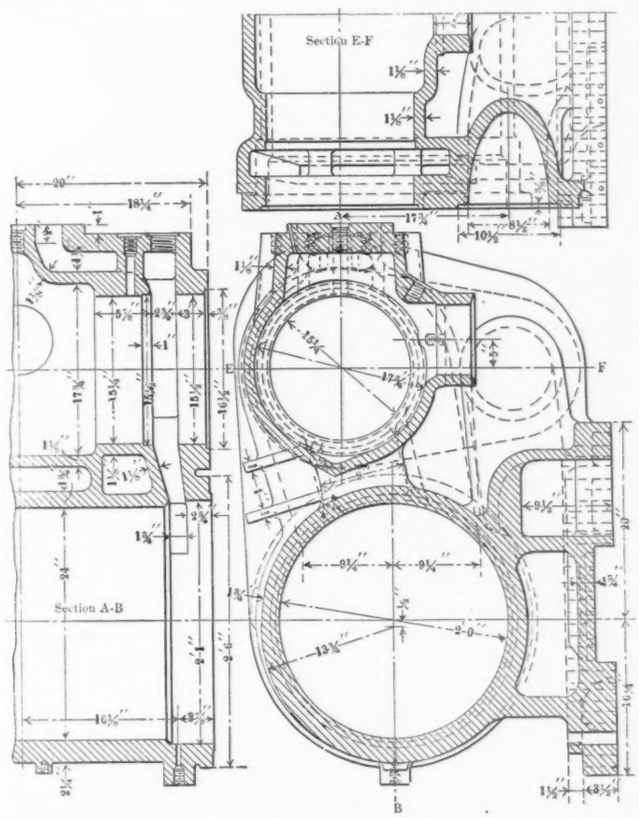


SELF-CLEARING ASH PAN FOR CONSOLIDATION LOCOMOTIVE—PENNSYLVANIA RAILROAD.



PENNSYLVANIA RAILROAD CLASS H8B CONSOLIDATION LOCOMOTIVE.

Ash Pan. One of the illustrations shows a design of self-clearing ash pan of large capacity, that has been applied to these locomotives. Its greatest point of interest is in the design and method of operating the doors, which in this case are hinged on either side and swing downward and outward. They are held in a closed position by a toggle joint arrangement, which insures them being securely fastened when closed without putting any great strain on the dumping gear. There are two large



CYLINDERS—CLASS H8B.

hoppers, front and back of the axle, each having individual door operating gear. The illustrations show that netting has been liberally used, both at the front and rear of the pan, and that no air openings are provided on the sides.

The general dimensions, weights and ratios are as follows:

GENERAL DATA.

Gauge	4 ft. 8½ in.
Service	Freight
Fuel	Bit. Coal
Tractive effort	42,661 lbs.
Weight in working order	238,300 lbs.
Weight on drivers	211,000 lbs.
Weight on leading truck	27,300 lbs.
Weight of engine and tender in working order	396,300 lbs.
Wheel base, driving	17 ft. ½ in.
Wheel base, total	25 ft. 9½ in.
Wheel base, engine and tender	59 ft. 5⅝ in.

RATIOS.

Weight on drivers ÷ tractive effort	4.95
Total weight ÷ tractive effort	5.60
Tractive effort × diam. drivers ÷ heating surface	690.00
Total heating surface ÷ grate area	69.64
Firebox heating surface ÷ total heating surface, per cent	4.88
Weight on drivers ÷ total heating surface	54.96
Total weight ÷ total heating surface	62.05
Volume both cylinders, cu. ft.	14.66
Total heating surface ÷ vol. cylinders	261.91
Grate area ÷ vol. cylinders	3.76

CYINDERS.

Kind	Simple
Diameter and stroke	24 x 28 in.

VALVES.

Kind	Piston
Diameter	14 in.
Greatest travel	6 in.
Steam lap	¾ in.
Exhaust clearance	⅛ in.
Lead	3/16 in.

WHEELS.

Driving, diameter over tires	62 in.
Driving, thickness of tires	3½ in.
Driving journals, main, diameter and length	10½ x 13 in.
Driving journals, others, diameter and length	9½ x 13 in.
Engine truck wheels, diameter	33 in.
Engine truck, journals	5½ x 10 in.

BOILER.

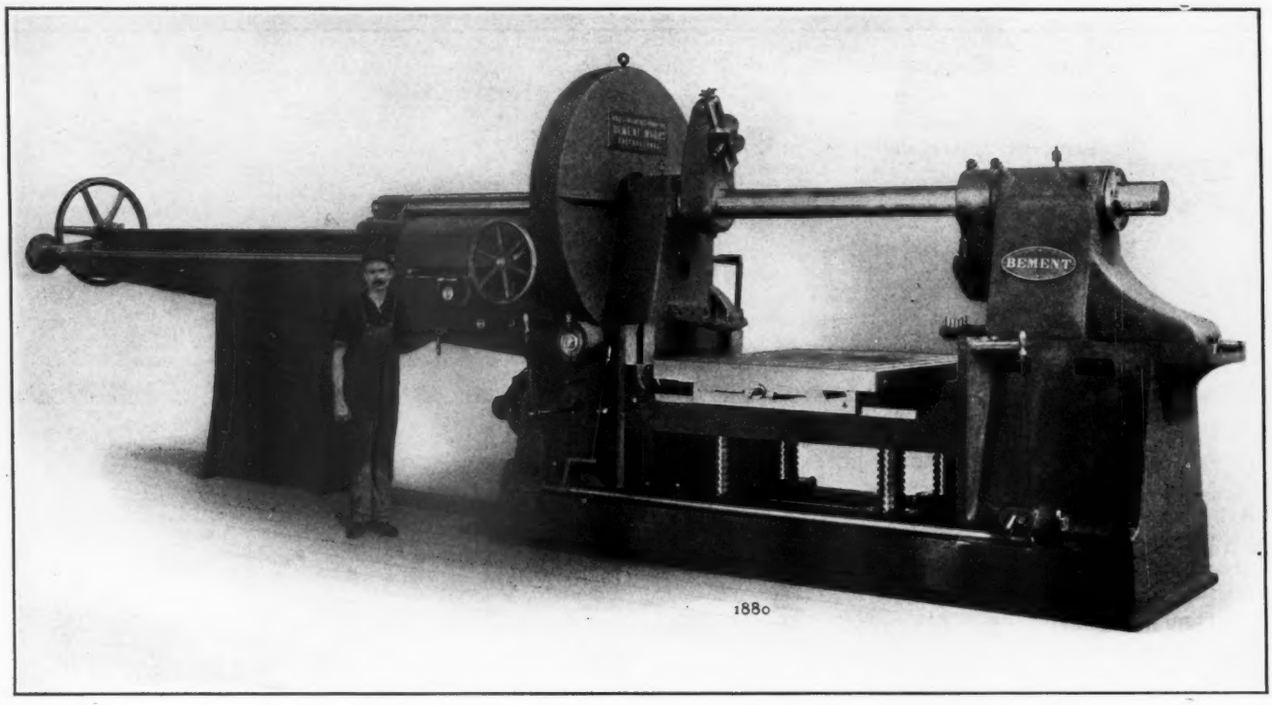
Style	Belpaire
Working pressure	205 lbs.
Inside diameter of first ring	76¾ in.
Firebox, length and width	110¼ x 72 in.
Firebox plates, thickness	5/16, ⅜, ½ in.
Firebox, water space	5 in.
Tubes, number and outside diameter	465—2 in.
Tubes, length	15 ft.
Heating surface, tubes	3,652 sq. ft.
Heating surface, firebox	187 sq. ft.
Heating surface, total	3,839 sq. ft.
Grate area	55.13 sq. ft.
Smokestack, min. diameter	17 in.
Smokestack, height above rail	180 in.
Center of boiler above rail	117 in.

TENDER.

Weight	158,000 lbs.
Wheels, diameter	36 in.
Journals, diameter and length	5½ x 10 in.
Water capacity	7,000 gals.
Coal capacity	17.5 tons

PANAMA CANAL.—Estimates of the sums required for the most economical conduct of the construction work during the next fiscal year amount to $48,000,000. This total is larger than those unfamiliar with the conditions at the Isthmus anticipated, but the reasons for it are sound. The rate of progress now is very high, amounting during September to 2,840,000 cu. yd. of excavation, 452,000 cu. yd. of fill-in dams, and 21,500 cu. yd. of concrete. The heavy interest charges on the great sums already spent make it advisable to push the work to the full economical capacity of the plant and organization. This capacity is greater than was anticipated, and consequently it is advisable to spend more each year and complete the canal sooner than will be possible with smaller annual appropriations.—*The Engineering Record.*

ACCURATE MEASUREMENTS.—A mechanic with his caliper gauge can readily detect differences of 1-10,000 of an inch; and a good tool maker with suitable parallel jaw calipers can detect differences of about 1-50,000 of an inch. Experts can detect a difference when working on small wires of one or two thousandths of an inch by the sense of touch or feeling and without the use of calipers.—*H. De B. Parsons.*



BEMENT-MILES CYLINDER AND PISTON VALVE CHAMBER BORING MACHINE.

LOCOMOTIVE CYLINDER AND PISTON VALVE CHAMBER BORING MACHINE.

The locomotive cylinder and piston valve chamber boring machine, shown in the illustration, will bore and face both ends simultaneously of cylinders up to 60 in. in length. This design has just been brought out by the Bement Works of the Niles-Bement-Pond Company. The boring bar is a steel forging 7 inches in diameter, has a continuous traverse of 11 feet by hand, fast power traverse in either direction, and automatic reversible boring feeds. The feeds are six in number and are actuated by a screw through a protected nest of gears; they are engaged, changed or reversed by a conveniently placed lever. The screw feed is of special advantage when boring piston valve chambers where the cutting is not constant, but is interrupted.

The main table is supported on four large elevating screws, the nuts of which are revolved by hand or power. The cross table is 54 inches wide in the direction of the machine's length by 72 inches long transversely; the top surface is fitted with T-slots for clamping the work. The table has a cross traverse of 30 inches and a longitudinal traverse of 18 inches by hand. The minimum distance from the center of the boring bar to the table is 30 inches, and the maximum 51 inches.

The facing heads are provided with tool slides having compound motion and are clamped in the boring bar sleeves. They have automatic star feed, and when not in use may be allowed to hang in place. The minimum distance between the facing heads is 20 inches, and the maximum 60 inches. When ordered, boring heads of various sizes may be provided to meet requirements. The machine is driven by a 20 horse-power motor geared direct and operated by a reversing controller. The same motor raises and lowers the table and operates the fast traverse to the bar.

HEADLIGHTS IN INDIANA.—The Railroad Commission of Indiana, after considerable investigation, has issued an order directing that headlights of 1,500 candle-power be used. The Indianapolis *News*, in commenting on this, says: "No oil lamp has yet been devised, as far as the commission could learn, which will attain the required candle-power, unless it be some modified form of the gasoline lamp. It is expected that the new lamps to be put in will be either electric or acetylene. Concerning a choice between these two, the commission has nothing to say."

SUPPLYMEN'S ASSOCIATION AT THE ATLANTIC CITY CONVENTIONS.

John D. Conway, secretary of the Railway Supply Manufacturers' Association, 313 Sixth avenue, Pittsburgh, Pa., has issued a circular announcing the principal features of the arrangements for the Master Car Builders' and Master Mechanics' conventions at Atlantic City, N. J., June 15-22 next. The exhibits and the offices of the association will be located on Young's Pier as before, with the exception of the track exhibits, which will be placed as they were in 1909, on the tracks of the Philadelphia & Reading Railway, about 200 yards from the convention pier.

Contract has been let for the erection of exhibit structures. It provides for 69,000 square feet of exhibit space, exclusive of aisles, and 40 cents per square foot will cover the cost of erecting structures and providing the usual facilities. The color scheme will again be green and white. A telephone will be provided between every two exhibitors with free local service from Monday, June 13, to Thursday, June 23. The upper floor of Exhibition Hall will not be used, and the lower floor will have ceiling and walls calcimined white. Eight candle-power electric lamps will be placed 2 feet apart along each of ten cornice lines and will be lighted throughout the day, so that each aisle will have two rows of these lights and each booth a row at the front and a row at the back. Annex court contains large spaces which may be built largely to suit occupants. The annex will have the column and panel construction substantially as in 1909, but very heavy exhibits cannot be placed on this end of the pier. Exhibits of medium heavy weight can be put in the addition to the hotel men's annex in the side spaces, as these are over concrete piles, but only light exhibits can go in the center spaces.

Power for operating exhibits will be furnished as heretofore. An additional boiler and a larger motor-driven compressor will be installed, and it is expected that with these additions all reasonable demands can be met.

Application for space should reach the secretary by January 31. On February 16, in Pittsburgh, space will be assigned to all exhibitors who have made application prior to that date, and the procedure will be substantially the same as in 1909. The exhibitors, if any, whose requirements, in the judgment of the exhibit committee, make it imperative that they be specially

taken care of, will be assigned space first. Lots will then be drawn to determine the order in which exhibitors may choose space. If a representative of the exhibitor is present, he may choose in his turn; if there is no representative present, the application will be used as a guide in assigning the best space possible. The number of advance applications already received indicates a very great demand for space.

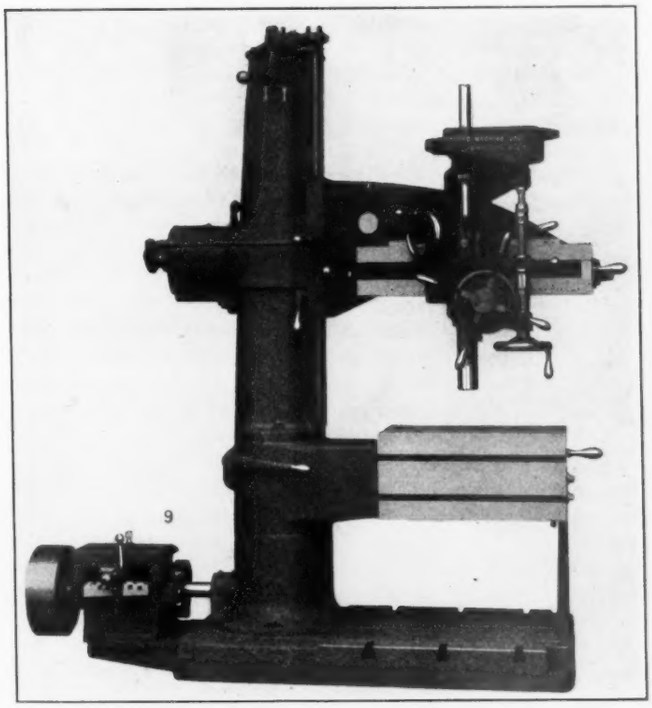
Mr. Conway calls attention to the resolution of the executive committee, prohibiting the distribution of souvenirs at the conventions; and also to the rule prohibiting the distribution of advertising matter from booth to booth.

NEW 36-INCH DRESES RADIAL DRILL.

The Dreses Machine Tool Company, Cincinnati, Ohio, in redesigning its line of radial drills, has given special attention to simplicity in the driving mechanism. One pair of bevel gears is carried inside of the column, thus obviating the use of the customary spur gears, one shaft and two bearings. The arrangement for transmitting the power to the drill spindle from the bevel gears remains the same as that used on previous designs.

The elevating screw is placed in a recess in front of the column, protecting it from damage and not impairing the swing of the machine. The lever protruding through the arm, near the column, operates a double friction which starts, stops, engages the back gears and reverses the spindle for tapping; any of these changes may be made while the machine is running. The lever above the one just mentioned sets the machine for tapping and also reverses the spindle at a ratio of 5 to 7, while the former lever reverses the spindle at a ratio of 1 to 4 forward and backward. A knurled screw on the main operating lever adjusts the gripping power of the driving friction clutch so that taps will not be broken off when striking the bottom of the hole.

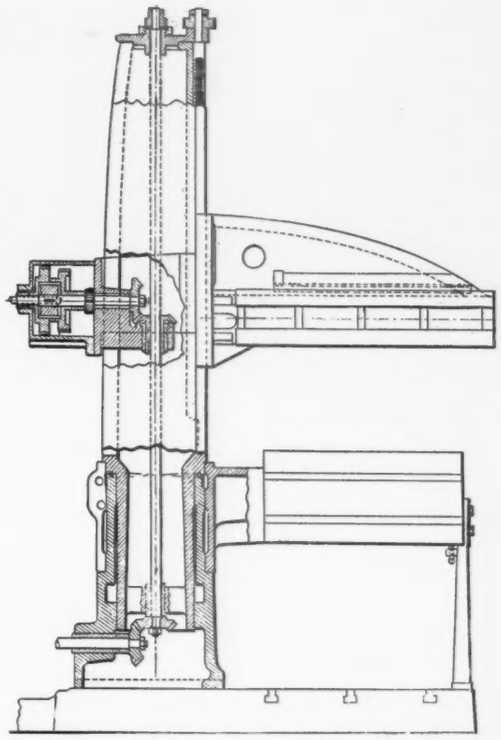
The head is moved on the arm by a rack and spiral pinion and



NEW DESIGN OF DRESES RADIAL DRILL.

is clamped by the lever at the rear of the vertical shaft carrying the worm that drives the feed. The quick return is through the four-handled pilot wheel which automatically engages and disengages the feed. The feed is of the all-geared type. It has four changes which are varied by a ducking key in connection with the knurled shiftable knob on the vertical worm shaft. The spindle has an automatic stop and is graduated for depth. The teeth are cut away at the extreme end of the rack to avoid breakage when the spindle is fed to the limit of its travel.

A novel feature of the machine is the connection of the column carrying stump, column and table. The column fits into the stump and rests on rollers for easy movement. The table encircles the lower stump and a small part of the column and by depressing the lever shown in front, a screw binds all three substantially together. This lever is always within reach of the left hand of the operator, without changing his position.



DRESES RADIAL DRILL.

A tension screw below the lever always insures a working fit. The table is supported at its outer end by a stand having an adjusting screw so that it can always be kept at right angles with the spindle.

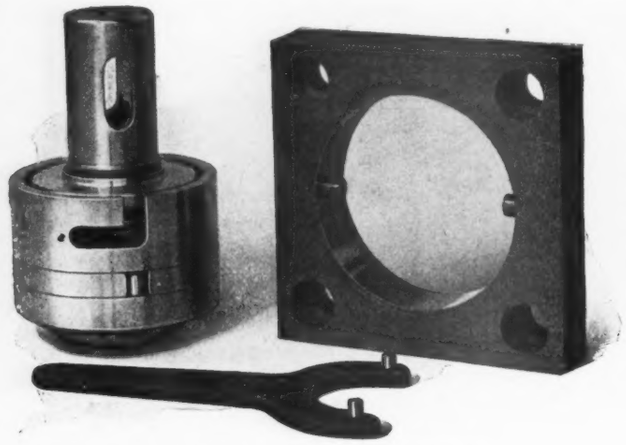
The machine is built with a cone pulley for belt drive, or constant or variable speed motors may be mounted on an attached sub-base. It drills to the center of a 73-in. circle, takes 58 in. under the spindle, and weighs about 3,600 pounds.

AN ELABORATE TRAIN FERRY.—The train ferry between Sassnitz, Germany, and Trelleborg, Sweden, a distance of 65 miles, was placed in operation by the two governments during the past summer. The ferries make the passage in four hours. Each is 370 ft. long over all, 53½ ft. wide, has a maximum speed of 16½ knots and will carry eight cars. The boats are fitted as passenger steamers, and in addition to carrying the cars have dining room, smoking room, and berth accommodations for 141 passengers. The staterooms are below the car deck, and provision is made for the first-class dining room and smoking room on a separate deck over the cars.—*The Engineering Record.*

DELAY TO PASSENGER TRAINS.—The monthly report of delays to passenger trains on the steam railroads in the State of New York, issued by the Public Service Commission, Second District, shows that for the month of October 56,230 trains were run, of which 84 per cent. were on time at division terminals. The average delay for each late train was 24 minutes, and the average delay for each train run was 3.9 minutes. The principal causes of delay were waiting for trains on other divisions, 30 per cent.; train work at stations, 16.5 per cent.; waiting for train connections with other railroads, 14.7 per cent.; meeting and passing trains, 7.5 per cent.; wrecks, 5.2 per cent.

FLOATING REAMER HOLDER FOR VERTICAL TURRET HEAD BORING AND TURNING MILLS.

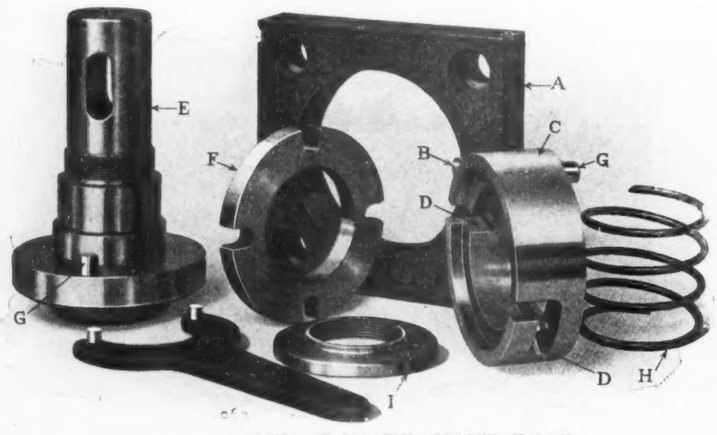
A floating reamer holder that has a number of advantages making it a most valuable appliance for users of vertical turret head boring and turning mills has been placed on the market



FLOATING REAMER HOLDER ASSEMBLED.

by the Colborn Machine Tool Company, of Franklin, Pa. Any make or style of reamer, whether solid or shell, adjustable or non-adjustable, can be used, it being only necessary that it have a Morse taper shank. The holder can be used on any make or style of vertical boring mill having a turret with flat sides.

Users of chucking machinery appreciate the advantage of using a floating reamer on the final finishing of the work, before removing it from the machine. When a reamer is held rigidly in position it is liable to produce a taper hole or ream the hole too large. With any machine like a boring mill, having a turret with a cross movement, the floating reamer is indispensable. This type of machine depends upon a center stop to bring the turret holes into alignment with the main spindle to which is attached the chuck or holding

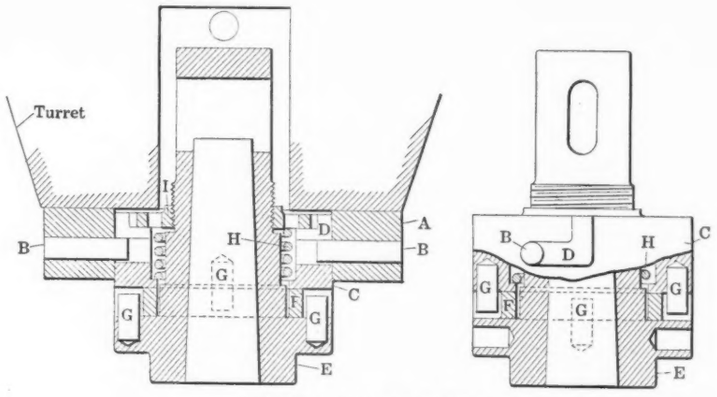


DETAILS OF FLOATING REAMER HOLDER.

fixture. Unless special care is exercised the operator will not bring the turret back to exactly the same position every time, even with the positive stop. The pressure of the hand on the crank handle is very likely to vary enough to change the exact alignment of the turret and the spindle a few thousandths of an inch, and reaming a hole with a reamer rigidly fixed in the turret would, under these conditions, cause the hole to be tapered or enlarged to a greater or less degree. This may be overcome by having the reamer so held that its axis is always maintained parallel to the center of hole, but at the same time so arranged that it has a slight self-adjusting tendency radially so that the hole and reamer will automatically keep in perfect alignment with each other This is what is accomplished by the use of the device shown in the illustration.

Referring to the drawing: Plate A is made to fit the face of the turret on any size or make of boring mill, and is fastened to it by four filister head screws. Sleeve C is held in plate A by two steel pins B, which are tight in plate A and made to fit freely in bayonet grooves D. Reamer holder E floats on sleeve C, the floating motion being obtained through the four steel pins G extending into the driving ring F. Two of the pins are tight in the holder E and two in sleeve C. The faces of sleeve C, driving ring F, and reamer holder E are held tight against each other by means of spring H, which insures the reamer being held true. Spring H is adjusted by means of nut I, which is turned with a spanner wrench furnished with each holder. It will be seen that plate A is the only part of the device that has to be made special to fit different makes of boring mills.

The photos show the various parts of the device in detail and assembled. The holders are made in two sizes, the No. 1 having a No. 4 Morse taper socket and capable of holding



FLOATING REAMER HOLDER.

reamers up to 3 inches in diameter, the No. 2 having a No. 5 Morse taper socket and capable of holding reamers up to 4 inches in diameter.

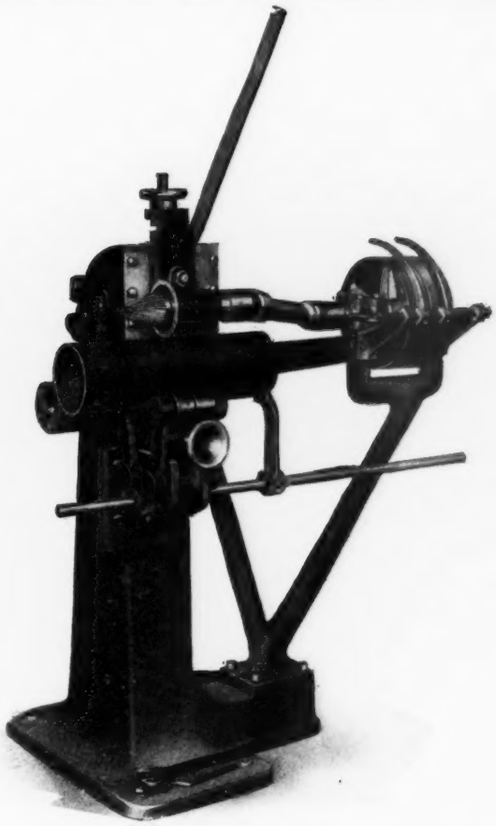
INTERNATIONAL RAILWAY FUEL ASSN.

The second annual meeting of the International Railway Fuel Association will be held at Hotel La Salle, Chicago, Ill., on May 23, 24, 25 and 26, 1910. The papers to be presented at the meeting and the committees in charge are as follows:

"Grade of fuel most suitable for locomotive use, considering cost per unit of traffic and best interests of producer. Recommended methods of preparing coal as to size for locomotives." J. G. Crawford, chairman, fuel engineer C., B. & Q. R. R., Chicago; Le Grand Parish, S. M. P., L. S. & M. S. Ry., Cleveland, Ohio; Curtis Scovill, A. G. S. A., Central Coal & Coke Company, Dallas, Texas.

"Standard uniform blank for reporting all items of cost in connection with fuel stations and handling fuel, for all types of stations and conditions." R. Emerson, chairman, Asst. to Gen. Mgr., Lehigh Valley R. R., So. Bethlehem, Pa.; F. V. Hetzel, chief engineer, Link Belt Co., Nicetown, Pa.; E. A. Averill, editor AMERICAN ENGINEER AND RAILROAD JOURNAL, New York, N. Y.; N. M. Rice, G. S. K., A. T. & S. F. Ry., Topeka, Kans.

"Accounting for fuel consumed. Individual records of performance." W. E. Symons, chairman, C. G. W. Ry., Chicago; E. A. Foos, C. C. Fuel, Rail and Tie Dept., C., B. & Q. R. R.,



FLUE CUTTING MACHINE WITH 6-INCH TUBE IN POSITION TO BE CUT.

Chicago; E. J. Roth, Jr., fuel inspector, B. & O., Baltimore.

"Methods of purchasing fuel with regard both to traffic conditions and to producers interests. Relation between producer and railroad." W. H. Huff, chairman, V. P., Victor-American Fuel Co., Denver, Colo.; L. L. Chipman, G. S. M., Fidelity Coal Mining Co., Kansas City, Mo.; W. K. Kilgore, fuel agent, C. M. & St. P. Ry., Chicago.

"Methods of supervision, instruction and encouragement in locomotive operation to secure greatest efficiency in fuel consumption." D. Meadows, chairman, Asst. Div. M. M. Michigan Central R. R., St. Thomas, Ont.; W. C. Hayes, Supt. Locomotive Operation, Erie R. R., New York, N. Y.; J. McManamy, R. F. of E., Pere Marquette R. R., Grand Rapids, Mich.

"Character of membership that should be encouraged in the association and steps to secure that membership." S. L. Yerkes, fuel agent, Queen & Crescent System, Lexington, Ky.

"Methods of kindling locomotive fires." C. F. Richardson, Asst. to G. S. M. P., C. R. I. & P. Ry., Chicago.

The officers of the Association are: Eugene McAuliffe, president, 'Frisco Lines, Chicago, Ill.; W. C. Hayes, first vice-president, Erie Railroad, New York, N. Y.; J. H. Hibben, second vice-president, M. K. & T. Ry., Parsons, Kans.; D. B. Sebastian, secretary, C. R. I. & P. Ry., 327 La Salle Station, Chicago; J. McManamy, treasurer, Pere Marquette R. R., Grand Rapids, Mich.

FLUE CUTTING MACHINE.

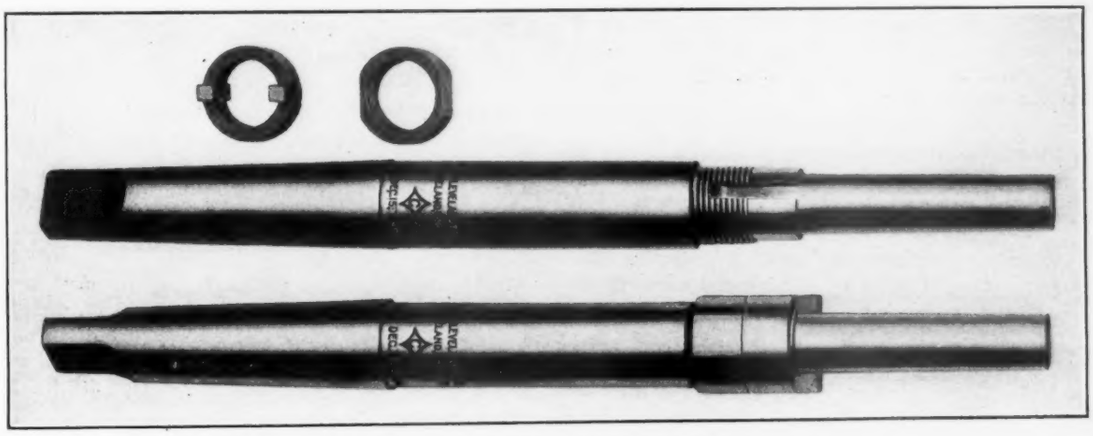
A flue cutting machine, having a capacity for cutting tubes or pipe from 3/8 to 6 in. in diameter has been placed on the market by Joseph T. Ryerson & Son, of Chicago, Ill. The machine is very rapid in operation. The cutter wheel is direct connected by means of a knuckle joint shaft to a 12 by 3 in. pulley, which operates at about 200 r.p.m. The object of the knuckle joint drive is to permit the tubes or pipes to be run out back of the machine so that they may be cut to any desired length. The feed of the cutter is accomplished by means of the hand lever shown, a balance weight being provided to secure an automatic release. The lever is so balanced that it requires but very little pull upon it to cut tubes of any size.

The rollers on which the tubes revolve are arranged so they can be brought close together or spread apart quickly to the proper distance for taking care of the various sizes of tubes or pipe. For reaming out the slight burr from the inside of the tube, which is sometimes caused by the cutting wheel, a fluted reamer is provided and attached to the end of the shaft as shown in the illustration. This reamer will ream tubes up to and including 3 inches in diameter. A larger reamer for tubes of greater diameter can be furnished and attached to the opposite end of the shaft just outside of the end bearing box. The machine is practically noiseless in operation and weighs approximately 825 pounds.

ARBOR FOR SHELL TOOLS.

A new arbor for shell tools is about to be placed on the market by the Cleveland Twist Drill Company, of Cleveland, Ohio. The essential difference between this patent arbor and the regular type is that it is equipped with an adjustable collar provided with integral keys which slide in longitudinal keyways in the arbor. The arbor is also threaded for a short distance to receive an adjusting nut which bears on the collar. The collar engages the shell reamers in the usual way.

Perhaps the chief advantage of the new arbor is the quickness and ease with which it releases the shell tool, no matter how tightly it may have become jammed on the arbor; a turn or two of the adjusting nut is all that is required, with no necessity for removing the arbor from the spindle and no excuse for the vise and hammer methods which often cause considerable damage. Another decided advantage is the fact that the collar can always be set so as to allow the shell tool to fit snugly on the arbor, and yet fully engage the collar keys with its slots.



ARBOR FOR SHELL TOOLS—CLEVELAND TWIST DRILL COMPANY.

PERSONALS.

Edward Wees has been appointed general foreman of the Ann Arbor Railroad at Frankfort, Mich.

G. R. West has been appointed general foreman of the Detroit, Toledo & Ironton at Springfield, Ohio.

J. T. Andrus has been appointed purchasing agent of the North Coast Railroad, with office at Spokane, Wash.

J. E. Mourno has been appointed assistant air-brake instructor of the Chicago, Rock Island & Pacific, with office at Chicago.

John D. Conway, secretary of the Railway Supply Manufacturers' Association, has changed his address to 313 Sixth avenue, Pittsburgh, Pa.

W. J. Davis has been appointed general foreman of the Detroit, Toledo & Ironton at Ironton, Ohio, vice J. H. Hott, resigned.

A. L. Roberts has been appointed mechanical engineer of the Lehigh Valley Railroad Company, with office at South Bethlehem, Pa.

Paul C. Withrow has been appointed mechanical engineer of the Denver & Rio Grande R. R., with office at Burnham station, Denver, Colo.

L. Fisher has been appointed master mechanic of the Fourth district, Central division, of the Canadian Pacific, with office at Winnipeg, Man.

R. P. Blake has been appointed master mechanic of the Montana division of the Northern Pacific Railway, with headquarters at Livingston, Mont.

Frederick N. Pease, assistant chemist of the Pennsylvania Railroad, at Altoona, Pa., has been appointed chemist, succeeding Dr. Charles B. Dudley, deceased.

J. H. Palmer has been appointed purchasing agent of the Georgia, Southern & Florida, with office at Macon, Ga., succeeding W. P. Hopper, promoted.

M. A. Craig has been appointed foreman of the Detroit, Toledo & Ironton at Lima, Ohio, vice G. B. Sollars, who has been assigned to other duties.

J. Murrin has been appointed superintendent of locomotive shops of the Chicago & North Western, with office at Chicago, succeeding Oscar Otto, resigned.

H. E. Smith has been appointed master car-builder of the Chicago & Alton at Bloomington, Ill. He was formerly with the New York Central at Albany, N. Y.

C. M. Hoffman has been appointed master mechanic of the Denver & Rio Grande, with office at Grand Junction, Colo., succeeding F. B. Mahoney, resigned.

John Hill, master mechanic and master car builder of the Minneapolis & St. Louis at Minneapolis, Minn., has been appointed master mechanic of both the Eastern and Western divisions, with office at Minneapolis.

H. P. Johns, chief draftsman of the St. Louis & San Francisco at Springfield, Mo., has been appointed mechanical engineer, with office at Springfield, Mo.

Robert W. Colville, master mechanic of the Galesburg division of the Chicago, Burlington & Quincy, was killed at Galesburg, Ill., December 28, by a locomotive.

W. J. Bennett has been appointed master mechanic of the Utah lines of the Denver & Rio Grande, with office at Salt Lake City, Utah, succeeding A. H. Powell, resigned.

J. A. Hannigan, general foreman of the Detroit, Toledo & Ironton at Springfield, Ohio, has been appointed to the same office at Jackson, Ohio, to succeed H. F. Martyr, resigned.

H. C. Stevens, assistant to the general storekeeper of the Atchison, Topeka & Santa Fe at Topeka, Kan., has been appointed supervisor of stores of the National Railways of Mexico.

R. S. Miller, general foreman car department of the New York, Chicago & St. Louis, at Cleveland, Ohio, has been appointed master car builder and his former title has been abolished.

D. B. Sebastian has been appointed acting fuel agent of the Chicago, Rock Island & Pacific, with office at Chicago, succeeding Eugene McAuliffe, general fuel agent, resigned. The title of general fuel agent is abolished.

C. S. White has been appointed motive power inspector of the Pennsylvania Lines west of Pittsburgh, Southwest system, with office at Columbus, Ohio, succeeding W. H. Holbrook, transferred.

C. E. Chambers, acting superintendent of motive power of the Central of New Jersey at Jersey City, N. J., has been appointed superintendent of motive power, with office at Jersey City.

O. S. Jackson has been appointed master mechanic of the Chicago, Indianapolis & Louisville, with office at Lafayette, Ind. W. J. Bennett, assistant superintendent of motive power, having resigned to accept service elsewhere, that office is abolished.

J. T. Langley, of Portland, Ore., for a number of years master mechanic for the Oregon division of the Oregon R. R. & Navigation Co., has been appointed master mechanic and an assistant general manager of the Oregon & Washington, at Seattle.

C. E. Allen, master mechanic of the Montana division of the Northern Pacific Railway, with headquarters at Livingston, Mont., has been appointed general master mechanic of the Yellowstone, Montana and Rocky Mountain divisions, with headquarters at Livingston.

Eugene McAuliffe, general fuel agent of the Rock Island-'Frisco lines at Chicago, has resigned from the Rock Island and has been appointed general fuel agent of the St. Louis & San Francisco, the Chicago & Eastern Illinois and the Evansville & Terre Haute, with office at Chicago.

C. M. Byrd has been appointed road foreman of engines of the Atchison, Topeka & Santa Fe Coast Lines, with jurisdiction over the second district of the Albuquerque division, with office at Winslow, Ariz., and will perform such duties as are assigned to him by the master mechanic of the third district.

B. T. Jellison has been appointed purchasing agent of the Chesapeake & Ohio, with office at Richmond, Va., reporting to the vice-president and general manager, succeeding W. F. La Bonta, who will perform the duties of fuel agent. The general storekeeper will report to the purchasing agent.

J. E. O'Brien has been appointed superintendent of motive power of the Western Pacific Railway Company, with headquarters at San Francisco, Cal. Mr. O'Brien was graduated from the mechanical engineering department of the University of Minnesota in 1898. He entered the service of the Northern Pacific Railway as a special apprentice and has had a very thorough training in mechanical department affairs, having at various times been foreman, master mechanic, assistant shop superintendent, engineer of tests and mechanical engineer of that road.

J. J. Ellis, formerly superintendent of motive power and machinery of the Chicago, St. Paul, Minneapolis & Omaha, died at Manchester, Eng., December 14. Mr. Ellis retired from the service of the Omaha road January 15, having reached his seventieth year, which made him eligible for a pension. In May he left on one of his periodical trips to England, expecting to return to his home at St. Paul, Minn., in the fall. Mr. Ellis was born near Leeds, Yorkshire, Eng. He entered the service of the Omaha road in 1877, and worked continuously with the company until his retirement. He was foreman of the shops at Hudson, Wis. He was promoted to St. Paul as general foreman in 1882, when the shops were moved there. He became master mechanic shortly after that time, and was promoted to superintendent of motive power and machinery in the nineties. Mr. Ellis was prominently identified with the civic affairs of St. Paul several years ago. He was a member of the board of education in the eighties and took an active part in political matters. He is survived by a widow, now in England.

Alfred P. Prendergast, assistant master mechanic at the Mt. Clare shops of the Baltimore & Ohio, at Baltimore, Md., has been appointed master mechanic, suceeding C. T. Turner, retired, after 47 years' service in the same shops. Mr. Prendergast entered the service of the Baltimore & Ohio as an apprentice in 1885 at Wheeling, W. Va., and after completing his apprenticeship he was engaged in the steel industry in the Pittsburgh and Youngstown districts. Several years later he returned to the Baltimore & Ohio as gang foreman at Benwood, W. Va., and then became machine shop foreman at Cumberland, Md., where he also served as roundhouse foreman. He was later made general foreman of locomotive and car repairs and then promoted to division master mechanic at Grafton. Two years later he was transferred to the Baltimore and Philadelphia divisions as master mechanic, with office at Riverside, Baltimore, leaving that position two years later to go to the Mt. Clare shops at Baltimore, as assistant master mechanic, which position he held at the time of his recent appointment.

C. T. Turner, for over six years master mechanic of the Mt. Clare Shops of the Baltimore & Ohio Railroad, has retired. Mr. Turner served his four years' apprenticeship from 1864 to 1867, inclusive; after working but little over a year as a journeyman machinist his ability was recognized and he was promoted in September, 1868, to assistant foreman, which position he held until December, 1874, when he was made machine shop foreman. In 1887 he was promoted to the position of general foreman of the shops. In June, 1903, his faithful services to the company were rewarded by making him master mechanic of the large system shops located at Mt. Clare, Baltimore, where there have been employed at different periods from 1,500 to 3,000 men. Mr. Turner was a bachelor, having ever since early boyhood cared for his mother, who was left a widow with a large family to raise; at the age of thirteen the responsibilities of caring for the family rested upon him, and he has taken care of them ever since. Mr. Turner is one of those sterling characters of whom men feel confident that in obtaining a decision from him on any of the questions of life they will receive impartial and equitable consideration. He will enjoy his remaining days in providing for the pleasures of his only remaining sister, who has been the home keeper of the family, and who has assisted him always in providing for the home; he feels that the time has come when he will have ample opportunity to devote to her enough time to afford those pleasures of life which business cares have heretofore prevented.

C. J. Morrison has resigned his position with the Emerson Company to engage in efficiency engineering on his own behalf. His office is at 52 East 19th street, New York City. Mr. Morrison was graduated from the mechanical engineering department of Cornell University in 1901. He took a position with the Northern Pacific Railway as a special apprentice and was with them in this capacity, and as a material inspector, until December, 1903, when he went with the Atchison, Topeka & Santa Fe Railway as a machinist. Several months later he was detailed as an assistant to Harrington Emerson, who had installed and was in charge of the betterment work in the mechanical department on that road. In this capacity he had charge of improving the conditions of the belting, with splendid results, as noted on page 455 of our December, 1906, issue. He was also engaged in making the shop dispatching schedules and in working out the surcharge problem; his articles in the *American Engineer* on these subjects during 1906 attracted a great deal of attention and undoubtedly were instrumental in doing much good. While acting as material supervisor, at the Topeka shops, the material cost for engines was reduced 25 per cent. Mr. Morrison was also very successful in the capacity of general erecting foreman at the Topeka shops. Later as standardizing engineer of the Santa Fe system he completed the work of the standardization of tools and machinery begun by Mr. Jacobs and made a good start toward the standardization of locomotive parts. In June, 1909, he resigned his position on the Santa Fe to become associated with the Emerson Company, "efficiency engineers," and in this capacity made reports on a number of large plants and personally supervised the efficiency work at two large establishments. Mr. Morrison is a member of the American Society of Mechanical Engineers.

BOOK NOTES.

The "Practical Engineer" Pocket Book and Diary for 1910. 684 pages, 3½x5½ in. Cloth, 25 cents, net. Leather bound, 40 cents, net. Published by The Technical Publishing Company, Ltd., 55 Chancery Lane, London, W. C.

Considerable new information has been added to this new edition, including data on fuel testing, condensers, friction of air and water in pipes, alloys, table of properties of metals, pyrometry, suction gas producers, emery grinders, etc.

Freight Transportation on Trolley Lines. By Chas. S. Pease. 62 pages, 5 x 7½ in., cloth. Price, $1. Published by the McGraw-Hill Book Company, 239 W. 39th street, New York City.

The author has gone into the question quite fully in a general way as to just how to build up a profitable freight business in connection with a trolley system. It is not intended to be a detail study, but is more in the line of a statement of the general conditions which will be encountered and how to handle them.

Technical Dictionary in Six Languages.

Volume V, Railway Construction and Operation, 870 pages, about 1,900 illustrations. Price, $4.00.

Volume VI, Railway Rolling Stock, 796 pages, about 2,100 illustrations. Price, $3.00.

The information in both of these volumes was compiled by August Boshart and edited by Alfred Schlomann. Published by the McGraw-Hill Book Company, New York City.

These two volumes are the latest ones to be issued in the series of illustrated technical dictionaries in six languages—English, German, French, Italian, Spanish and Russian. The four volumes previously issued are: Vol. I, Machine Details and Tools; Vol. II, Electrical Engineering; Vol. III, Boilers, Steam Engines and Turbines; Vol. IV, Internal Combustion Engines.

CATALOGS

IN WRITING FOR THESE PLEASE MENTION THIS JOURNAL.

No Climbing.—This is the title of a circular issued by the L. M. Booth Company, 136 Liberty street, New York City, briefly describing the Type "F" Booth water softener.

Jeffrey Booklets.—Wire cable conveyors is the subject of Booklet No. 33 and standard elevator buckets the subject of Booklet No. 34, issued by The Jeffrey Mfg. Co., Columbus, Ohio. These are 3½ by 6 in. in size and are clearly printed in small type and profusely illustrated.

Belt Engineering.—*Phoenix*, a journal devoted to belt engineering, published by the New York Leather Belting Company, 51 Beekman street, New York City, has been enlarged and greatly improved. Sample copies will be furnished to those interested without charge.

Ferroinclave.—An attractively arranged catalog from The Brown Hoisting Machinery Company, Cleveland, Ohio, considers the adaptability and the advantages of Ferroinclave for roofing, siding, flooring, stairways, cornices and mouldings, water tanks and bins.

How 4 Cars of Coal Did the Work of 5.—A booklet under this title from the H. W. Johns-Manville Co., 100 William street, New York City, forcibly emphasizes the value of the use of Asbestos-Sponge Felted Covering for pipes and Vitribestos Boiler Covering for boilers.

Electric Mine Locomotives.—Bulletin No. 17 from The Jeffrey Manufacturing Company, Columbus, Ohio, describes the electric mine locomotives manufactured by them. It contains 66 pages, is 8 by 10 in. in size, and is thoroughly illustrated with half-tone views showing the different types of these locomotives.

Cutting and Welding Metals.—The American Oxhydric Company, Milwaukee, Wis., has issued a booklet describing the oxhydric process for cutting and welding metals. A number of typical applications of the process are illustrated and tables are given showing the consumption of gas and the time required for cutting and welding different thicknesses of metal.

An Exhaust Steam Turbine Installation.—The statement that with no additional steam the net output of a non-condensing engine plant may be increased 75 per cent. by exhaust-steam turbines cannot fail to result in more than a passing interest. A bulletin (No. 4712) from the General Electric Company takes up the subject in considerable detail and is, in fact, a reprint of an article in *Power and The Engineer*. It contains, also, an article entitled "Increasing the Output of Steam Plants," reprinted from the *Textile Manufacturing Journal*, and some notes on the low pressure turbine.

Variable Release Air Brake Equipment.—The rapid extension of the electrification of steam railroad lines and the heavier service demanded on many electric roads requiring the operation of long trains, have necessitated radical improvements in automatic air equipments to adapt them to the higher schedule speeds, shorter headways and more nearly accurate stops in electric service. The General Electric Company in Bulletin No. 4703-A describes its Variable Release Air Brake Equipment, which eliminates the defects usually found in the standard automatic air brake equipment for electric service.

Mallet Articulated Compound Locomotives.—This is the title of the first of a series of bulletins which the American Locomotive Company, 30 Church street, New York City, expects to issue monthly, and which will treat of various subjects of interest both from an engineering and operating standpoint, and as descriptive of the development of American locomotive design. The bulletin, designated as No. 1000, contains 12 pages, 8 by 10 inches in size. A brief description of the Mallet compound and its advantages and some suggestions as to the service for which it is adapted, is followed by illustrations of a number of different designs of this type that have been built by the American Locomotive Company for roads in this country and abroad. Each one of these locomotives is illustrated by a half-tone illustration and a line drawing giving the general dimensions. These are accompanied by tables giving the general specifications and data as to the hauling capacity under different conditions.

Graphite Engine Front Finish.—The ordinary and usual treatment of locomotive front ends has a number of unsatisfactory features. It requires frequent renewal, which means not only cost of material, but also cost of labor. Some of the material used is volatile, and when the engine is running and the front end becomes hot, offensive fumes come back to the cab. In aggravated cases these fumes fill the eyes of the engineer, almost blinding him for the moment, and making it difficult to see the signals. For engine front ends The Joseph Dixon Crucible Company, Jersey City, N. J., recommend their Graphite Engine Front Finish, which is said to give a service of from six to nine weeks at each application and provides an attractive coating. The value of this finish is due chiefly to the flake graphite which forms its base. It is unaffected by heat or cold and has, in addition, durable polishing properties. The Dixon Company has recently issued a circular describing this engine front finish.

Gasoline Electric Plants for Lighting and Power.—This is the title of an attractive publication, No. 4707, issued by the General Electric Company, which is of interest to those contemplating the installation of a small or isolated plant, not within reach of the distributing circuit of a central station. The pamphlet illustrates and describes complete generating units consisting of a direct current generator mounted on the shaft of a gas engine.

Curve-Drawing Ammeters and Voltmeters.—In Bulletin No. 4706, recently issued by the General Electric Company, is illustrated and described the company's type CR curve-drawing ammeters and voltmeters. This type of instrument gives a clear, permanent record of the characteristics of the electric circuit to which it is applied, and will be found of value in locating trouble with electrical apparatus, in proving the efficiency of machines and workmen, especially where the individual drive system has been adopted, and in determining the correct size and style of the new machine. This instrument is suitable for use on either alternating or direct current.

Fuel Economizers and Air Heaters.—Catalog No. 150 from the B. F. Sturtevant Company, Hyde Park, Mass., is most attractively arranged, and thoroughly and clearly discusses the advantages and the design and construction of the Sturtevant fuel economizers and air heaters. Carefully prepared illustrations show the operation as well as the construction of the economizers. A number of concrete examples are given showing the savings which are possible by their use. The Sturtevant new high pressure type economizer, with all joints metal-to-metal, will stand working pressures up to 500 pounds per square inch; the doing away with gasket joints eliminates chance of leakage. With the Sturtevant design of positive scraper mechanism, the scrapers cannot stick or bind, thus eliminating one of the troubles found in earlier designs of economizers.

The engineering section at the rear of the catalog contains data on the efficiency of fuels, the properties of saturated steam, the percentage of saving effected per degree increase in feed water, the percentage of saving effected by heating feed water from initial to final temperature, and the influence of temperature upon chimney draft.

Calendars have been received from the Buda Foundry & Manufacturing Company, Harvey, Ill., the Duff Manufacturing Company, 50 Church street, New York City; John Lucas & Co., Philadelphia, Pa.; the American Wood Working Machinery Company, Rochester, N. Y.; the Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio; H. B. Underwood & Co., Philadelphia, Pa., and the Bettendorf Axle Company, of Bettendorf, Iowa. The latter one is especially attractive and was designed by Bruce V. Crandall, of Chicago. The calendar itself is suspended by two cords from a miniature gilded Bettendorf bolster. On each sheet is shown a large drawing of special design, reproduced in the duo-tone process. Among the drawings, which include views of methods of manufacture in the Bettendorf plant, several are to be particularly noted. The illustration on the January sheet is of a map of the United States, and falling across it is the shadow of the Bettendorf one-piece truck frame; underneath the picture are the words "Coming events cast their shadows before." The Bettendorf plant by moonlight in February shows the big plant as it stretches for nearly a mile along the Mississippi river. Another very effective picture is of the open-hearth furnace into which are being thrown the forty-one pieces of the arch-bar truck frame. At one side a moulder is pouring out the one-piece Bettendorf truck frame in the sand. For June, which is the month of the M. M. and M. C. B. conventions, the illustration is of a young lady ready to board the train for Atlantic City. In August the Bettendorf bears take their vacation. For December, Justice is represented as standing on a world holding her scales, the balance beam of which is an elongated Bettendorf truck frame. Weighing down one side is shown the Bettendorf truck, up on the other side the arch-bar truck. Underneath the picture are the words of the handwriting on the wall, "Weighed in the balance and found wanting."

A handsome calendar has been received from The American Tool Works Company; also a loose leaf desk calendar from the Flannery Bolt Company of Pittsburgh.

NOTES

W. N. Best.—The W. N. Best American Calorific Company has retired from business and Mr. Best is personally manufacturing and selling the oil burners, regulating cocks and various types of furnaces invented by him. His office is at 11 Broadway, New York City.

Rockwell Furnace Company.—J. W. Coyle, who was connected with the Best American Calorific Company, is now with the Rockwell Furnace Company, making a specialty of oil and gas furnaces for railroad work. Mr. Coyle was formerly master blacksmith for the "Lehigh" at Wilkes-Barre, and later in charge of the drop hammer and machine department at the forge shops of the "Reading" at Reading, Pa.

The Watson-Stillman Company.—Several additions have been made to the sales department to handle the increasing business in hydraulic tools and turbine pumps. Edwin Stillman has entered this department, and is assisting in taking care of customers in New York State, while all southern railroad business is now in charge of Frank C. Clark. The more direct representation that has become necessary in the Orient will be in the hands of F. W. Horn, the well known machinery importer of Yokohama, Japan.

AN EXPERIMENTAL MALLET ARTICULATED LOCOMOTIVE*

CANADIAN PACIFIC RAILWAY.

G. I. EVANS.

A Mallet articulated locomotive was designed and constructed by the Canadian Pacific Railway, under the direction of H. H. Vaughan, assistant to the vice-president, during 1909, which embodied some very unique and original features.

Construction-General.

Reference to the general drawings of the locomotive shows that there is considerable difference between this design and other Mallet locomotives recently put into service on American railways. The most striking difference is in the arrangement of the cylinders, the shortness of the front bumper or footplate, the position of the superheater and the absence of front and back guiding trucks. This arrangement of cylinders, whereby the two pairs are brought together near the center of the locomotive, permits of an extremely simple pipe arrangement, cutting out a number of packed expansion joints, every one of which is a continual source of trouble through leakage. The removal of the cylinders from the front also permits of shortening the over-all length of the locomotive; as locomotives of this type are very long every foot possible must be saved to permit of their being taken into existing engine houses.

Provision has been made for changing the piston packing rings by simply removing the front cylinder heads, disconnecting the main rod from the crosshead and pushing the piston out into the space between the two cylinders; the piston valves have also been taken care of in a similar manner so there can be no objection to this arrangement on account of inaccessibility.

Boiler and Superheater.

The boiler is of the wagon top type, as shown by Fig. 2, is radially stayed and has an unusually small front ring and smokebox; there are three separate compartments in the barrel, the front of which is practically a feed water heater and owing to its small diameter is full of water all the time. The injectors discharge into this compartment which is connected to the boiler proper by two equalizing pipes 4 in. in diameter, one of which is located on the side center line and the other on the top.

The second or middle compartment is for the superheater which consists of double loops of 1¼ in. seamless steel tubing dropped down into the path of the hot gases from the firebox. There are 69 of these superheater elements; one end of each connects to the saturated steam header which takes steam from the boiler, and the other connects to and discharges into the superheater header which is connected direct to the high pressure cylinders. When the locomotive was first turned out the superheater was connected to the low pressure cylinders, but as a result of tests made subsequently it was changed as described. The reasons for this are explained in another part of this article. Two ¾ in. blower pipes are so located as to blow jets of steam diagonally across the superheater compartment, through the tubes, to bring down any soot which may collect.

There is no steam in the superheater pipes when the throttle is closed, but no cases of burning out have developed after about four months' service; nor is any trouble anticipated as this condition applies, although to a lesser degree, to other types of superheaters that are giving good service. The superheater pipes are secured to the headers by union nuts and are readily removable for repairs, one element at a time, through the opening at the top of the boiler which is closed by a flanged steel door. If necessary the complete superheater, header and tubes may be lifted out bodily.

The back compartment is the boiler proper, or steam generating section, and the construction is similar to ordinary boilers except that the radii at the corners of the firebox, both inside and outside, are larger than usual. This has been done to decrease the rigidity of the sheets, which, it is believed, is largely responsible for staybolt breakage on the end rows. There are four flue sheets in the boiler and two sets of flues; the front set is 96 in. long and the back 109 in., with a 63 in. superheater compartment between, and although cleaning holes have been applied underneath, it is seldom found necessary to use them, all cinders being carried through by the action of the draft.

As before stated, the front section of the boiler is really a feed water heater and has 281 tubes 2 in. O. D. and 12 tubes 2¼ in. O. D., giving 1,230 square feet of heating surface, leaving 1,555 square feet in the steam generating section (tubes and firebox). The measure of the steaming capacity of this locomotive as expressed by the formula, $\frac{\text{T. P. (max.)}}{\text{H. S. (total)}} \times$ dia. drivers, is shown in comparison with others of similar type in the following table; as the Canadian Pacific locomotive has a superheater the equivalent heating surface has been used:—

Road.	Builder.	$\frac{\text{T. P. (Max.)}}{\text{H. S. (Total)}} \times$ dia. drivers.
Can. Pac	Can. Pac.	975
B. & O.	Am. Loco. Co.	715
Gt. Nor. (Road)	Bald. Loco. Wks.	813
Gt. Nor. (Pusher)	Bald. Loco. Wks.	690
Erie	Am. Loco. Co.	910
D. N. W. & P.	Am. Loco. Co.	775
Cen. Brazil	Am. Loco. Co.	915

In using this factor in comparisons it must be borne in mind that the lower its value the greater will be the capacity of the boiler as a steam generator, and, from the above table, it might seem that the Canadian Pacific locomotive would not steam satisfactorily; this, however, is not the case as an inspection of the boiler pressures in Figs. 9 and 11 will show.

The injector check valve is located on the top center line of the boiler and consists of a cast iron body with connections for the right and left-hand injectors and a third connection suitable for a pipe or hose coupling which is used for filling or blowing off the boiler.

Throttle, Steam and Exhaust Pipes.

The throttle valve is located on the top of the boiler outside and consists of an iron casting having two 5 in. steam pipe connections, one on either side; the joint to the boiler is made by a brass ball ring having an opening 12¾ in. in diameter. The throttle casting extends down through this and connects to a cast iron dry pipe which takes steam from a dome set further forward on the same course; the arrangement of this is shown clearly on the boiler drawing, Fig. 2.

Outside steam pipes lead from the throttle to the saturated header of the superheater, and steam, after passing through it, goes directly to the high pressure cylinders, also through outside pipes which are heavily lagged to prevent condensation, as are also the pipes from the throttle. This portion of the piping

*This article is furnished, by special agreement, jointly to the AMERICAN ENGINEER AND RAILROAD JOURNAL and the Canadian Railway Club.

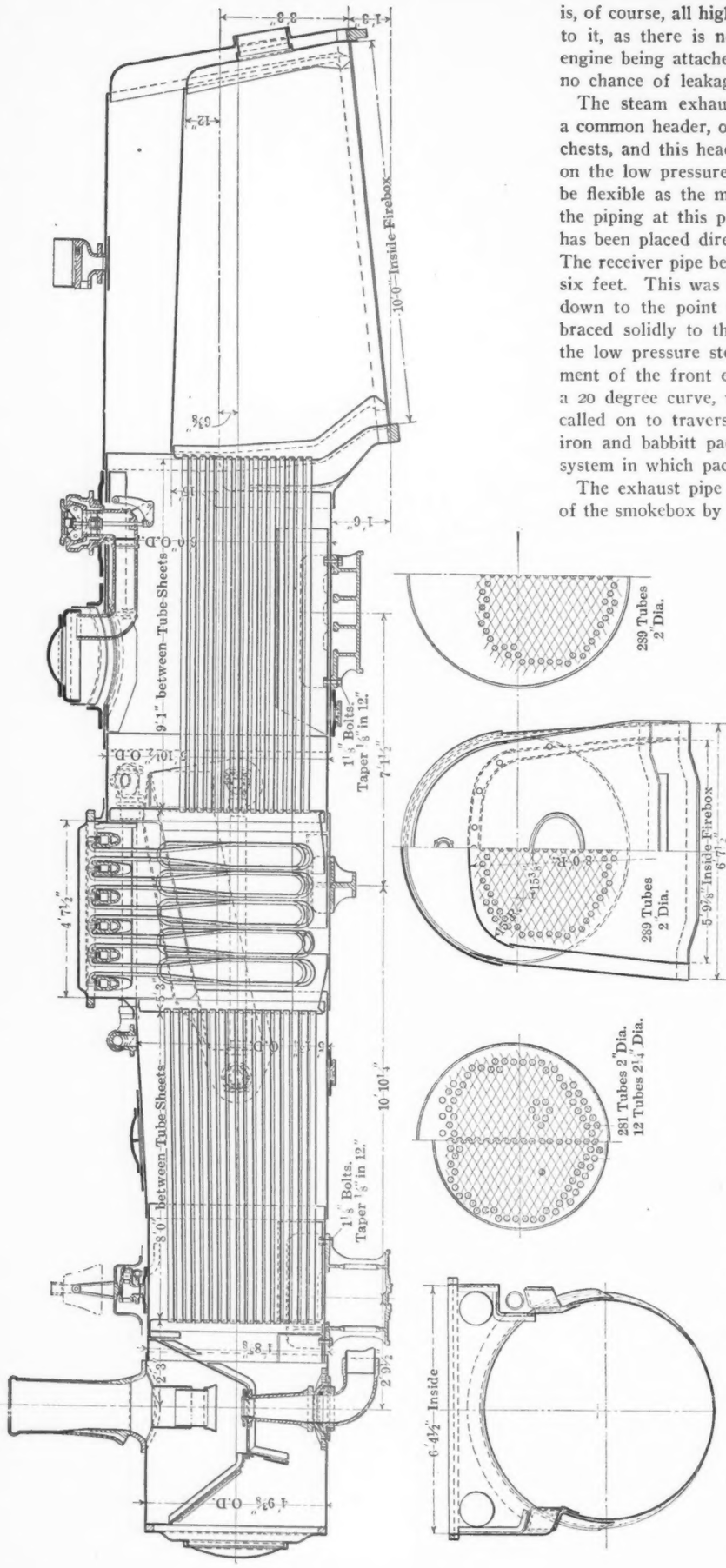


FIG. 3.—BOILER AND SUPERHEATER, MALLET COMPOUND LOCOMOTIVE—CANADIAN PACIFIC RAILWAY.

is, of course, all high pressure, but no special importance attaches to it, as there is no movement in the pipes, the high pressure engine being attached rigidly to the boiler. There is, therefore, no chance of leakage if the joints are properly made.

The steam exhausts from both high pressure cylinders into a common header, or receiver, bolted over the ends of the steam chests, and this header connects by a 7 in. pipe to a similar one on the low pressure cylinders, which connection, however, must be flexible as the movement of the front truck begins to affect the piping at this point. To minimize its effect, the connection has been placed directly over the pivot point of the front truck. The receiver pipe between the two headers extends upward about six feet. This was done to give sufficient volume, and this pipe down to the point where it enters the low pressure header is braced solidly to the boiler and the connection which bolts to the low pressure steam chest rotates about it due to the movement of the front engine. This rotation is about 5 degrees on a 20 degree curve, which is the greatest the locomotive will be called on to traverse. The joint is packed with alternate cast iron and babbitt packing rings and is the only one in the pipe system in which packing is used.

The exhaust pipe connects to the cylinder and the under side of the smokebox by ball joints and both ends have a small rotary movement, but, as the angular movement is only 2 ft. 34 in. on a 20° curve, the extension between the connections is only ⅜ in., which is taken up by the sliding of the pipe flanges on the flat faces of the ball rings. The flanges are held to their seats on the ball rings by 10 springs of 200 lbs. capacity each, or a total of 2,000 lbs. The extension due to the truck movement being provided for in this way, the use of a packed expansion joint is unnecessary.

The arrangement of this portion of the piping, which may be called the low pressure system, is shown by Fig. 3; the dotted lines show the movements of the pipe on a 20° curve and the diagram underneath shows the movements of the pipes as they would have been if the low pressure cylinders were at the front of the engine. A comparison of the two arrangements shows that with the cylinders at the front the angular movement of the exhaust pipes would be 15° 19′ and its extension 1⅝ in., which would necessitate the use of two universal ball joints with packing and a packed expansion joint instead of the two simple ball rings which are sufficient to take up both the rotary movement and extension. The receiver pipe movement would be the same provided the connection to the high pressure cylinders was directly over, or close to the frame connection pin. This pipe is usually given flexibility by a packed universal ball joint and a packed expansion joint.

From the above it will be seen that with the low pressure cylinders at the front and following the usual pipe construction, five packed joints would have been used, but with the arrangement adopted there is only one packed joint and two ball rings.

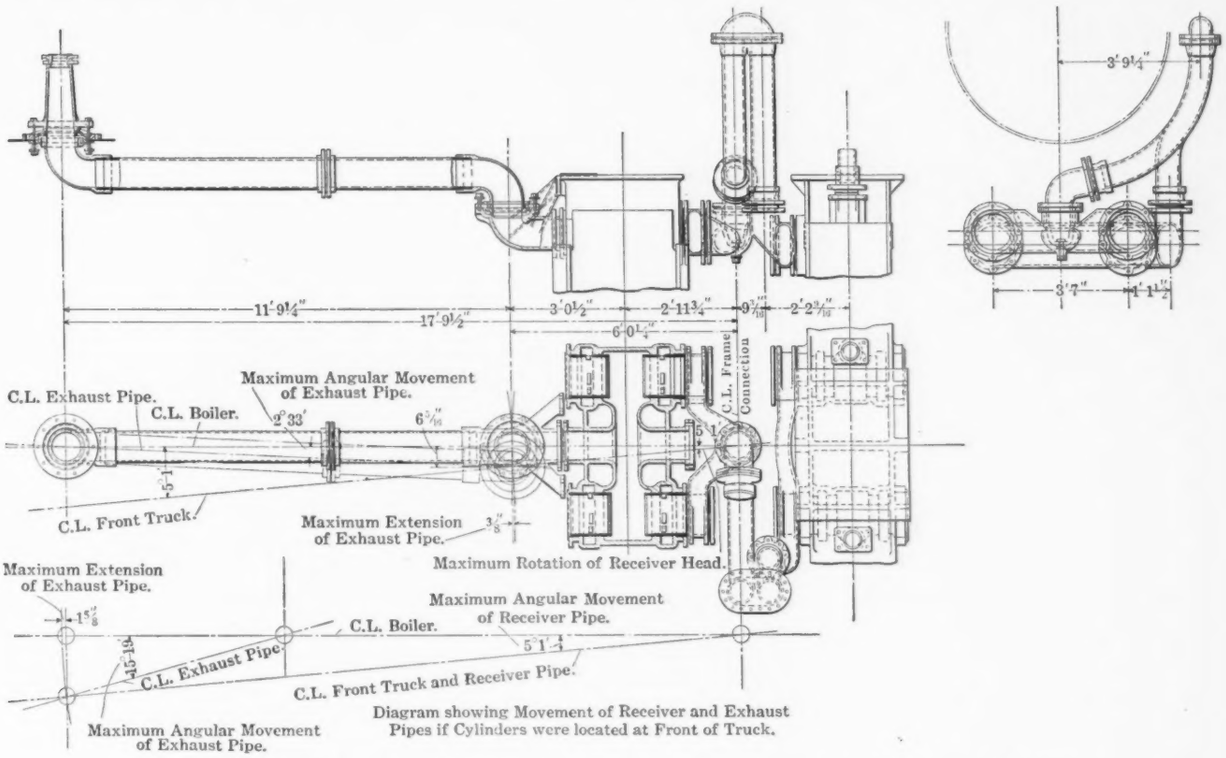


FIG. 3.—STEAM, EXHAUST AND RECEIVER PIPES. DOTTED LINES SHOW POSITION ON A 20° CURVE.

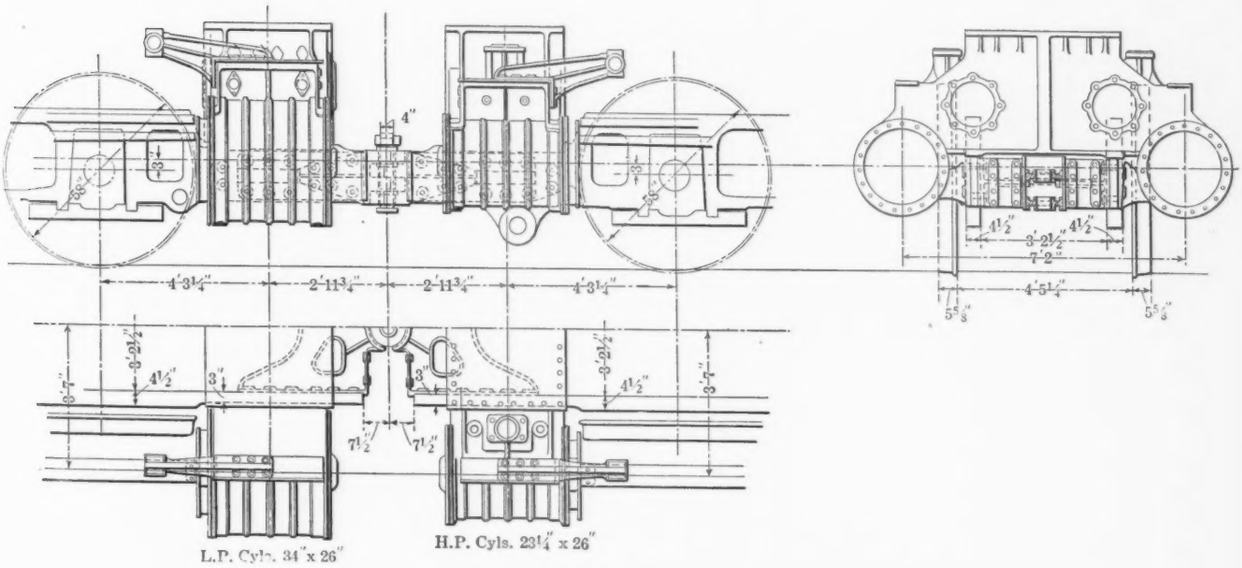


FIG. 4.—ARRANGEMENT OF CYLINDERS AND FRAME CONNECTIONS.

Cylinders, Valves and Valve Motion.

The cylinders are of the piston valve type with inside admission on the high pressure and outside on the low pressure which permits of the most satisfactory arrangement of steam pipes. The diameters are: high pressure, 23¼ in. by 26 in. stroke; low pressure, 34 in. by 26 in. stroke; all four are cast separately without saddles and are bolted together by vertical flanges in the usual manner. The high pressure cylinders have a cast steel saddle, which is common to both cylinders and which bolts rigidly to them and to the boiler. This connection to the boiler is a very important one, the barrel being under pressure at this point and the saddle is secured with 1¼ in. bolts, having a taper of 1/16 in. in 12 in., driven into holes reamed from the pressure side.

The low pressure cylinders have no saddle, as there is a movement between the boiler and truck at this point. A small steadying casting has, however, been applied with slides across the flat surface on the top of the cylinders, but no weight is transmitted to the truck by it.

The main frames are slabbed to a section 15 in. deep by 3 in. wide at the cylinder fits and are braced laterally by the frame connection castings which join the engines together. The arrangement of the cylinders and their fastening is shown in Fig. 4.

Walschaert valve motion is used; the design varies but slightly from that used on other Canadian Pacific locomotives, except in

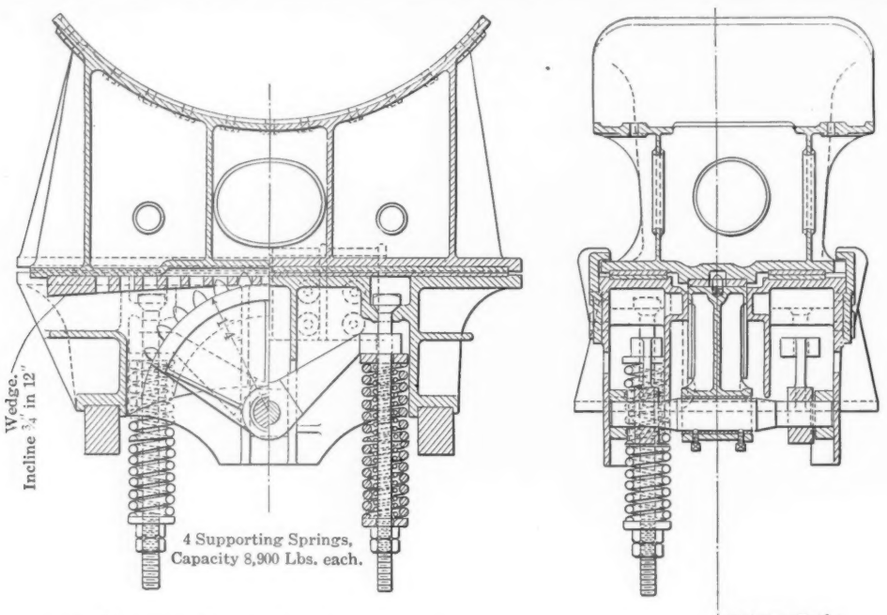
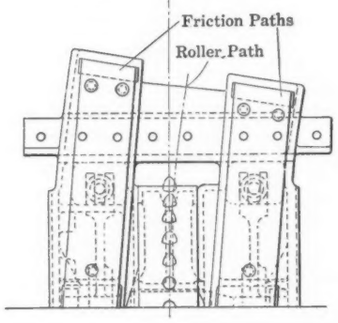


FIG. 6.—BOILER BEARING AND GUIDING DEVICE.



the radius bar lifting link on the low pressure engine which, of course, must have flexible connections to permit of movement between the boiler, to which the reversing arm is attached, and the truck. It must also be made as long as possible, as, when the locomotive is rounding a sharp curve the boiler will swing about 9 in. off the center line of the truck at this point, and the angle taken by the lifting link causes the radius bar to raise in the radius link, shortening the travel of the valve when the engine is in forward gear and lengthening it when in backward, the radius bar being down for forward and up for backward gear. This applies to all Mallet locomotives having the radius bar suspension arranged in this manner, but is comparatively unimportant if sufficient clearance is allowed between the radius link and block at the top.

Provision has also been made for varying the cut-off in the low pressure cylinders independently of the high pressure; that is, the low pressure cut-off may be lengthened or shortened without affecting the high pressure.

Reference to the general drawing shows that the high pressure reverse shaft has two arms on the right-hand side; one of these is 11½ in. long and is connected to the power reverse cylinder, the stroke of which is 12 in. As the high pressure radius bar lifting arm is forged to the same shaft, the lift or fall of the radius bar is always proportional to the travel of the power reverse cylinder piston. The arm on this shaft has a slotted upper end, with a sliding block, to which the low pressure reach rod pin connects; this block is held in any desired position by means of a screw adjustment. The shortest length of the arm is 12½ in. and with the longest power piston travel of 12 in. the movement of the reach rod is $\frac{12}{11.5}$ x 12.5 or 13 in. nearly; if, by means of the screw, the reach rod block is moved up to 14 in. from the shaft the movement of the reach rod becomes $\frac{12}{11.5}$ x 14 or 14.6 in., with a consequent increase in the rise or fall of the low pressure radius bar, which will increase the travel of the valve.

A simple form of power reverse gear is used, consisting of a 6 in. steam cylinder with its piston rod connected to the reach rod shaft, as described above; rapid movement is prevented by an oil dash pot, the piston of which is connected to the same rod as the piston of the power cylinder.

Frames, Spring-Rigging and Weight-Distribution.

The frames on each engine are in one piece and are slabbed for the cylinder fits and for the front bumper and back footplate which makes a very simple arrangement, there being no frame splices to break or get loose. At the same time it gives a stronger cylinder fastening; the sections of the top and bottom rails of these frames are 4½ in. wide by 4½ in. deep, top, and 4½ in. wide by 3 in. deep, bottom, on both frames. Owing to the rather unusual conditions of weight distribution, the design was gone into very carefully and the sections not only checked against the piston thrust, which is usually all that is considered, but against the weights carried by the frames. The bending moment and shearing forces for the front engine are shown by Fig. 5; these

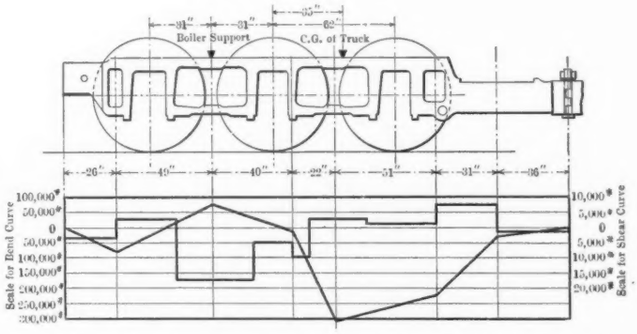
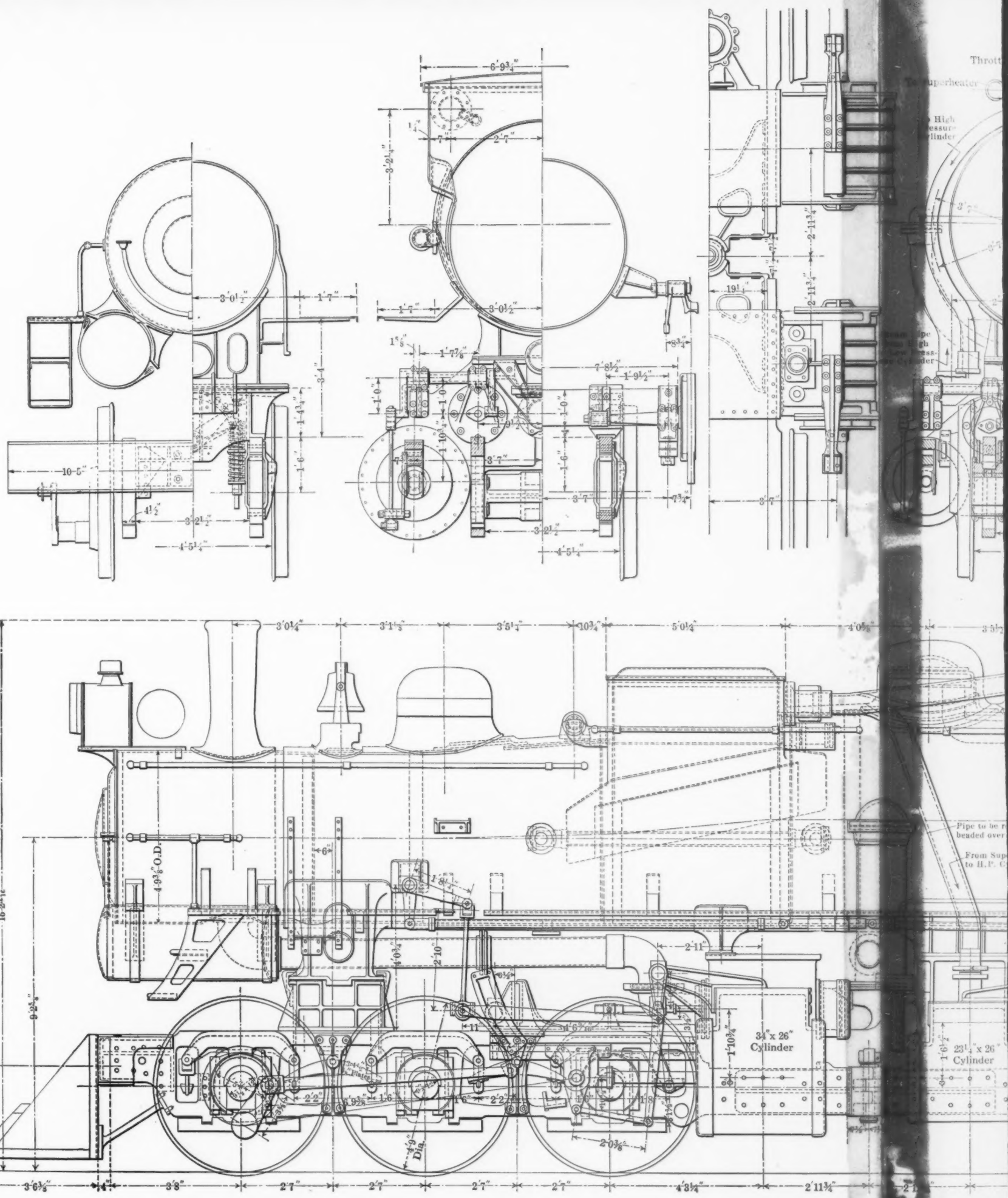


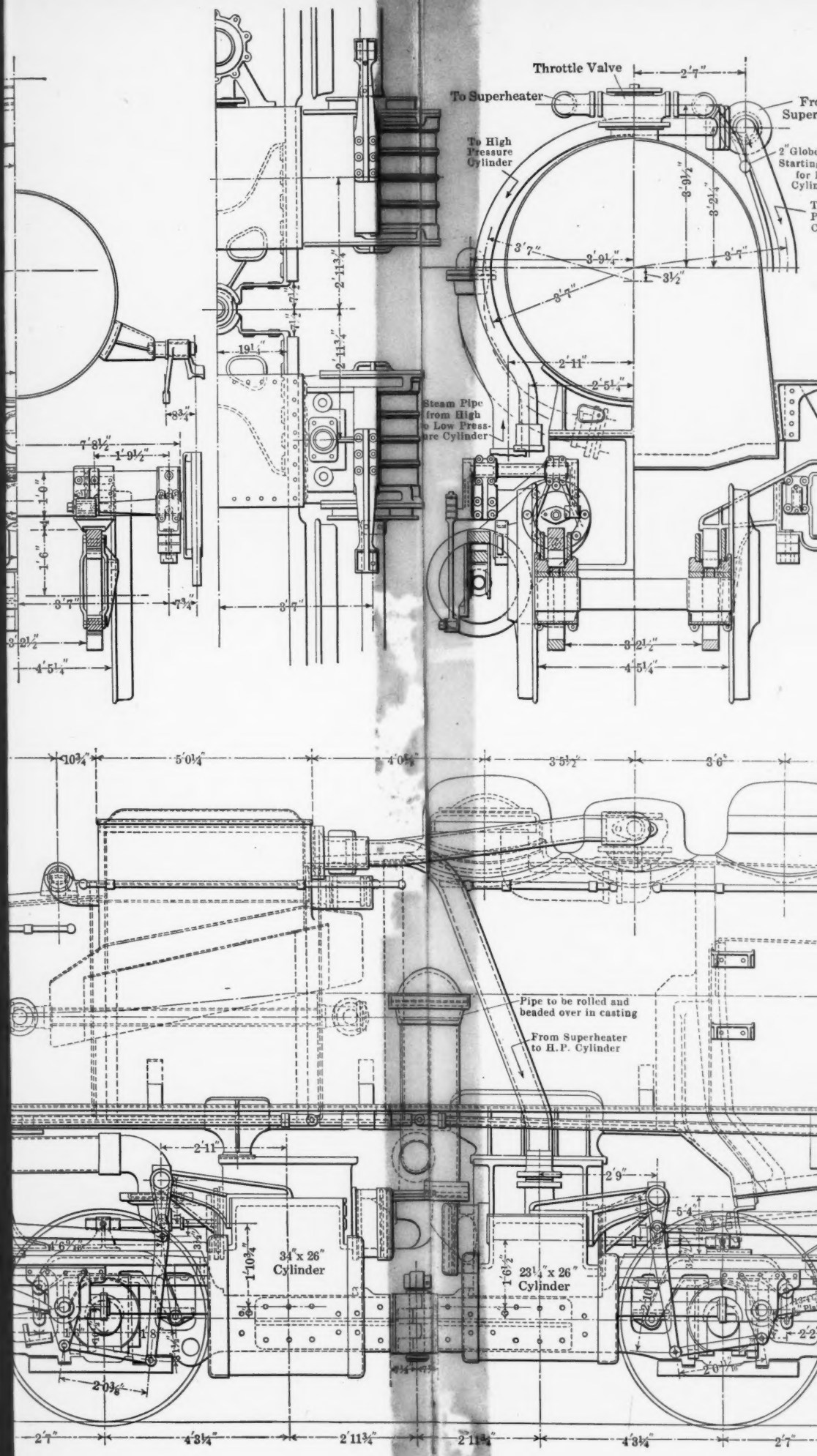
FIG. 5.—DIAGRAM OF BENDING MOMENT AND SHEARING FORCES.

have been worked out considering the frame as a beam supported at four points (where it rests on the springs), the re-action being equal to the sum of the loads supported by the springs.

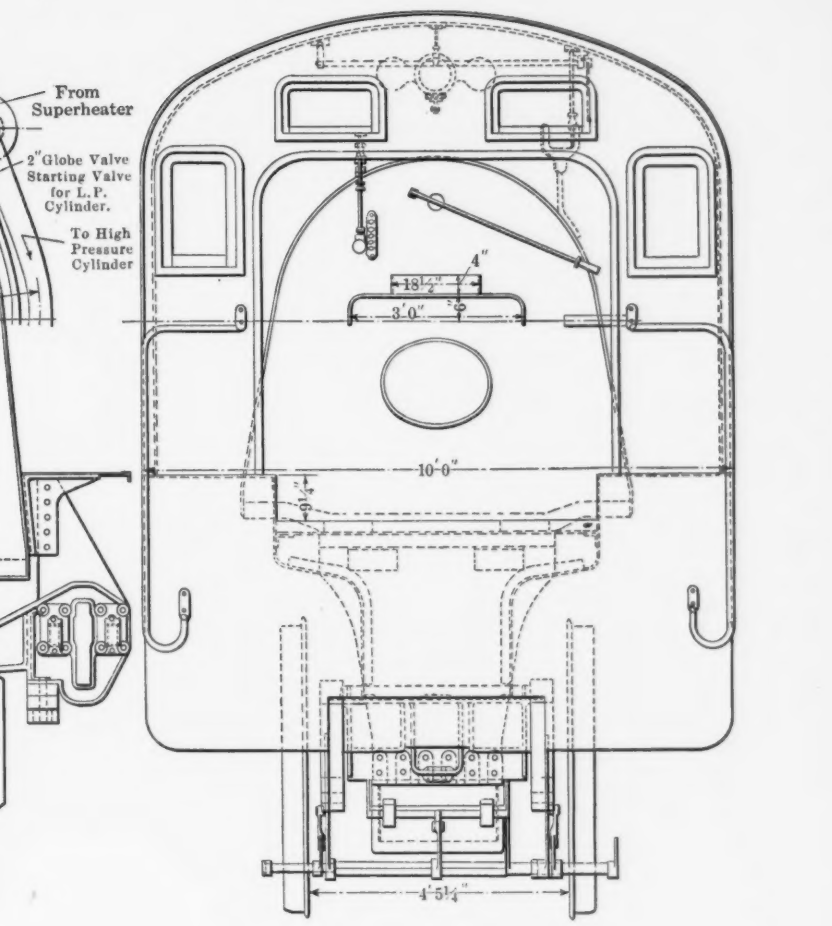
This diagram shows that the proportion of the boiler weight carried by the front engine is concentrated at a point midway between the first and second wheels or 31 in. ahead of the middle wheel, and as this is the only point on the front truck at which the boiler is supported the weight must be such that its moment about the center of the truck will equal the moment of the weight of the front truck itself, acting at the distance its center of grav-

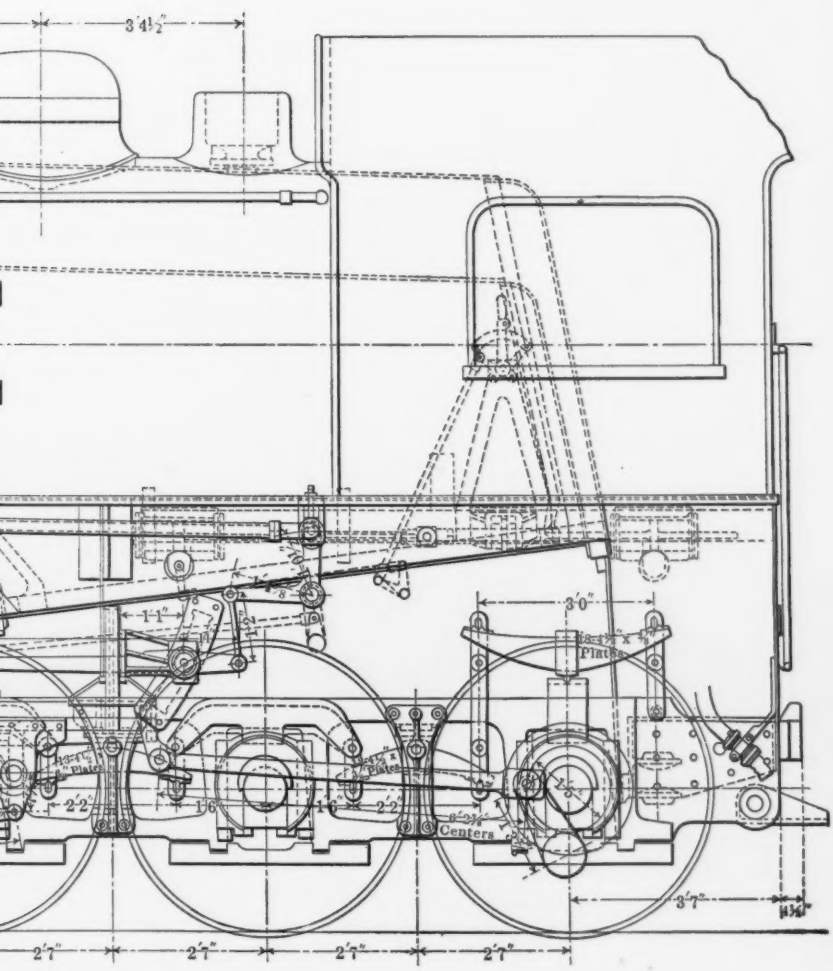


ELEVATION, SECTIONS, AND PARTIAL PLAN AT CYLINDERS OF MALLET COMPOUND (0-6-6-0)



PLAN AT CYLINDERS OF MALLET COMPOUND (o-6-6-o) LOCOMOTIVE, CANADIAN





NADIAN PACIFIC RAILWAY.

ity is located in the rear of the center of the truck. On most Mallet locomotives now in service this is not the case; the actual point of support of the boiler on the frames is set forward (considering a truck with the cylinders at the front) of the virtual point sufficiently far to make the moment of the truck weight considerably greater; this is done to prevent rocking in a longitudinal direction, and, of course, tends to allow the truck to drop at the front, to correct which, a suspension bolt working on ball seats connects the lower rail of each back engine frame to the upper rails of the front engine. Any tension put on them by screwing up on the adjusting nuts pulls down on the rear end of the front engine frame correcting the effect of the center of gravity of the front system falling ahead of the center of the truck.

On the Canadian Pacific Mallet this rocking effect is checked by the frame connection castings which have jaws that interlock in such a manner as to make longitudinal rocking impossible. The arrangement of these castings and their pin connection is clearly shown by Fig. 4; the construction at the joint is very substantial. A turned pin 4 in. diameter is used, and with this arrangement of interlocking jaws the pin is put in triple shear when pulling, but for buffing shocks which are more severe it is entirely relieved and the shock is taken up by the socket joint formed by the metal around the pin on the front casting fitting into a machined pocket on the back casting.

As the extension of the exhaust pipe due to the truck movement must be taken up by the sliding of the pipe flanges on the ball rings, and as only a rotary movement has been provided for on the receiver pipe, the importance of having a solid connection for the frames of the two engines is seen.

The spring rigging is of an ordinary type; the front engine is equalized from back to front and has a cross equalizer at the front; the rear engine is also equalized through its whole length, but has no cross equalizers. The weights carried by the front and back engines are not equal but are so distributed that approximately 9,000 lbs. more weight is carried by the front than by the back. As the effect of pushing or pulling a train is to reduce the weight on the front truck and the service for which the locomotive was built calls for continued maximum tractive effort for considerable distances, it is important that the ratio of the adhesive weight to tractive power be sufficiently high to ensure the engine holding the rail. As this ratio is 4.57, which is about as low as is desirable, it will be seen that any transfer of weight from the front truck would further reduce the adhesion factor and tend to make the front engine slip.

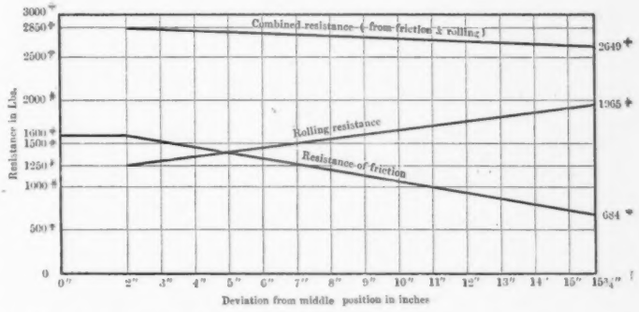
Guiding Power of the Front Engine.

The weight of the boiler, which offers the principal resistance to curving as the truck must swing laterally underneath it, is partly supported by friction plates and partly by a spring suspended roller. The arrangement of this device is shown by Fig. 6 and its action is as follows: There are two main castings, one of which is mounted on the frames and the other bolted solidly to the boiler moves with it across the frame casting. The weight of the boiler and attachments resting on the front truck at this point is 40,000 lbs., and one-half of this, or 20,000 lbs., is carried on friction plates, four of which are set on each casting forming two approximately radial paths, with an 8¾ in. space between. The total area of these plates is 834 square inches, and provision has been made for lubrication, each plate having oil grooves connecting with an oil box on the top casting; under these conditions the co-efficient of friction may be taken as .08, which gives 1,600 lbs. at starting, as the resistance due to friction; this resistance decreases slightly, as will be explained later.

In the 8¾ in. space between the two friction paths on the upper casting is the roller path, which consists of two wedge shaped blocks having an incline of ¾ in 12; these are set with their thin ends at the center line between the frames, and these ends have also been made flat for a distance of 2 in. on each side of the center.

The roller on which the inclined blocks travel is carried by two equalizers supported on springs, which in turn are carried by the bottom castings; any movement of the truck sideways, as when entering a curve, causes the inclined blocks to force the roller downward against the resistance of its supporting springs, which produces a force to pull the boiler around the curve with the truck, and relieves the leading flanges of the back engine from the excessive pressure which would otherwise result. The greater the movement of the truck sideways, the greater will be the deflection of the springs, and there will be a constantly increasing rolling resistance as indicated by the truck guiding power chart, Fig. 7, which shows the curve marked "rolling resistance" as starting at a point which corresponds with the beginning of the incline or 2 in. from the center; the resistance at this point rises immediately to 1,250 lbs. and increases to 1,965 lbs. at 15¾ in., or the maximum movement sideways.

As mentioned above, the frictional resistance decreases slightly; this is due to the reduction of weight on the friction paths as the truck moves sideways, caused by the additional weight carried by the springs, and consequently by the roller also. The decreasing frictional resistance is shown by the drop in the curve marked "frictional resistance," and begins 2 in. from the center, or the point where the roller picks up weight. The total resistance offered by the boiler to the truck moving sideways is shown by the curve marked "combined resistance." When the locomotive is entering a curve, for the first 2 in. truck movement to either side, the resistance is only that due to friction, or 1,600 lbs. When straightening out, as on leaving a



When boiler is in middle position:
Load on sliding surfaces..... 20,000 lbs.
Load on springs..... 20,000 lbs.
Inclination of wedge, ¾ in 12.
Coefficient of friction taken at .08.

FIG. 7.—GUIDING POWER OF FRONT TRUCK.

curve, the inclined surfaces tend to slide the boiler back to its normal position on the center of the truck against the increasing frictional resistance, thus relieving the pressure on the flanges.

The resistance may be entirely altered by changing the inclination of the wedges, or the amount of rolling or frictional resistance may be varied at will by screwing up or slacking off on the roller supporting spring nuts, which has the effect of increasing the weight on the roller and decreasing the weight on the friction plates, or vice versa.

The total resistance, however, would not be materially altered unless the incline of the wedges was changed, which may easily be done by raising the boiler at the front, as the wedges are not cast solid with the top casting, but are held in pockets in it.

Tests.

As the locomotive was of an experimental nature, a number of tests were made to determine if the desired results were being obtained. These tests were not directed towards the amounts of coal and water consumed, or the economy of the machine as compared with other heavy road locomotives, but were more as a check on the design in general to show what changes would be desirable in locomotives of the same type constructed in the future.

Special attention was therefore directed towards the following:

(1) The receiver and exhaust pipes and their connections.

(2) The boiler and machinery—whether the boiler was of sufficient capacity to supply steam to the cylinders and what improvements could be made in the details of the latter.

(3) The ability of the locomotive to curve freely; that is, to

traverse curves having a radius as short as any on which it would have to operate and to do this at ordinary speeds both heading and backing on, without danger of derailing, or excessive flange wear.

(4) The ability of the locomotive to develop the calculated tractive power.

(5) The most satisfactory size of cylinders and arrangement of reheater or superheater; that is, what diameter of cylinders within the limits of 22 in. to 23¼ in. on the high pressure and 32½ in. to 34 in. on the low pressure would give the best results using either reheated steam in the low pressure or superheated in the high pressure.

Of these 1, 2 and 3 could be settled by observation of the locomotives when pulling the test trains and on a 20° curve, as well as in regular service later. Nos. 4 and 5 necessitated the use of the dynamometer car and indicators.

The locomotive was particularly adapted for experiments as to the size of cylinders and arrangement of reheater or superheater; the cylinders had bushings which would permit of varying their diameters, and the outside arrangement of steam pipes made possible the use of a reheater for the high pressure exhaust, or a superheater in direct communication with the boiler at small cost.

It was apparent from the first that the receiver and exhaust pipes would do what was expected of them, and, during the period of about 10 days when the locomotive was under test. and 3 weeks observation subsequently during the regular service, no leakage of steam developed, nor was it even necessary to tighten up on the packing gland on the receiver pipe or the bearing plates of the sliding ball rings on the exhaust pipe. Owing to its length the exhaust pipe has considerable capacity as a receiver and the exhaust is very mild, but this may be considered as an advantage, as no difficulty is experienced in maintaining full steam pressure. Some leakage developed around the taper bolts which hold the high pressure cylinder saddle to the boiler, and on future locomotives other systems of fastening will be considered.

All curves were traversed freely, both heading and backing on, and from observations made on a "Y" on which the rails were light and the curvature about 18° at one point, it was proved conclusively that the articulated locomotive did less damage and curved easier than an ordinary 2—8—0 locomotive weighing 185,000 lbs. with a rigid wheel base of 15 ft. 10 in. and a total wheel base of 24 ft. 4½ in., the pony truck having 5 in. x 8 in. three-point hangers.

The amount of flange wear after about 4,000 miles was 3/64 in. at the point of contact between the rail head and flange on the leading wheels, and 1/32 in. on other wheels. This is satisfactory service considering the crookedness of the track on which the locomotive operated, there being a large number of 10° curves; this amount of wear also compares very favorably with that on other locomotives in the same service.

The size of the cylinders on the locomotive as first turned out were 22 in. and 32½ in. x 26 in., or a ratio of 2.18, and the exhaust from the high pressure pair passed through the reheater before entering the low pressure steam chest. Three other combinations of cylinders and positions of reheater or superheater were tried, and altogether six tests were made before the final size of cylinders was determined.

A large number of indicator cards were taken and those shown by Fig. 8 are fairly representative of each test. In the "Summary of Indicator Cards" the measure of steam at cut-offs is expressed in terms of the following:

Steam at cut-off = (T. P. per lb. M. E. P. x cut-off % + T. P. per lb. M. E. P. x clearance %) x pressure at cut-off + 14.7.

Fig. 9 shows the dynamometer car record, indicated and dynamometer horse powers, speed, boiler pressures, etc., for tests 4 and 5.

In tests 1, 2 and 3, which were made under similar conditions, it was found that there was practically equal amounts of steam in each pair of cylinders and that the low pressure cylinders were developing considerably greater power than the high pressure. This condition can best be accounted for by the increased volume of steam in the receiver due to its being reheated and consequently expanded, causing excessive back pressure on the high pressure pistons, as indicated by the drop in pressure between the back pressure line on the high pressure cards and the admission line on the low pressure.

To more nearly equalize the power, it was decided to increase the diameter of the low pressure cylinders to 34 in., or a ratio of 2.38, which would have the effect of emptying the receiver more rapidly, with a consequent decrease in back pressure and rise in M. E. P. on the high pressure pistons without materially changing the amount of work done by the low pressure.

The reheater was left connected to the receiver, the lack of condensation at the cylinder cocks being very noticeable, which

SUMMARY OF INDICATOR CARDS

Test	Card	M. E. P.	H. P.	Indicated Tractive Power	Steam at Cut-Off Measure	Steam at Cut-Off %	Work Cylinder %	Tractive Power Total	Horse Power Total
1	5 HP	90	164	19500	37700		41		
	5 LP	60	238	28500	37600	99¾	59	48000	804
	6 HP	86	157	18650	33800		43		
	6 LP	52	207	24700	32320	96	57	43350	728
4	44 HP	98.5	117	21300	41000		45		
	44 LP	50	142	26000	38750	95	55	47300	518
	46 HP	91.5	109	19800	40950		44		
	46 LP	48.5	139	25200	38600	94	56	45000	496
5	2 HP	111.5	124	24200	42500		48		
	2 LP	50.5	134	26300	37300	87½	52	50500	516
	3 HP	117.5	116	25550	44250		47½		
	3 LP	54.5	128	28200	38600	87	52½	53750	488
6	9 HP	100	194	24300	48000		46		
	9 LP	55	229	28600	40100	83¾	54	52900	846
	10 HP	90.5	193	24150	47400		45		
	10 LP	57	236	29600	40750	86	55	53750	858

For "steam at cut-off %" the largest measure in each pair of cards is taken as 100%.

Test No. 1, Cyls. 22" & 32½" x 26", Ratio 2.18, Reheater connected to L. P.
Test No. 2, Cyls. 22" & 32½" x 26", Ratio 2.18, Reheater connected to L. P.
Test No. 3, Cyls. 22" & 32½" x 26", Ratio 2.18, Reheater connected to L. P.
Test No. 4, Cyls. 22" & 34" x 26", Ratio 2.38, Reheater connected to L. P.
Test No. 5, Cyls. 22" & 34" x 26", Ratio 2.38, Superheater " to H. P.
Test No. 6, Cyls. 23¼" & 34" x 26", Ratio 2.14, Superheater " to H. P.

was a desirable feature. The maximum temperature obtained in the low pressure steam chest using reheated steam was 440°, which, with a pressure of 75 lbs., would give 120° superheat. The result of this arrangement is shown by Test No. 4 and made considerable improvement in the distribution of power, although the equalization could still be improved.

At the conclusion of this test the reheater pipes were changed to connect to the high pressure steam chest and the receiver pipe, as shown by Fig. 3, was applied. Superheated steam would thus be used in the high pressure cylinders and the exhaust would pass direct to the low pressure steam chest.

The amount of steam shown by the low pressure indicator cards in Test No. 5 now averaged about 87% of that shown by the high pressure cards, and the total amount of power as calculated from the series of indicator cards was approximately equal between the two engines.

It was next decided to try and increase the total power of the locomotive, which could still be done, as the factor of adhesion could be reduced without going below safe limits.

The most satisfactory ratio as indicated by the previous tests would have been 2.38, as shown by Test No. 5, but as the bushing had been removed from the low pressure cylinder, its diameter could not be further increased and the high pressure only was changed, its diameter being increased to 23¼ in., or a ratio of 2.14. Although the low pressure cylinder diameter could not be increased, its cut-off could be lengthened by means of the adjusting arm, previously described, without changing the cut-off in the high pressure, which would have a similar effect in reducing the back pressure on the high pressure pistons.

The results obtained with this arrangement are shown by Test No. 6, and everything considered it was the most satisfactory which had been tried; the power had been increased and the amounts developed by each engine were reasonably well balanced.

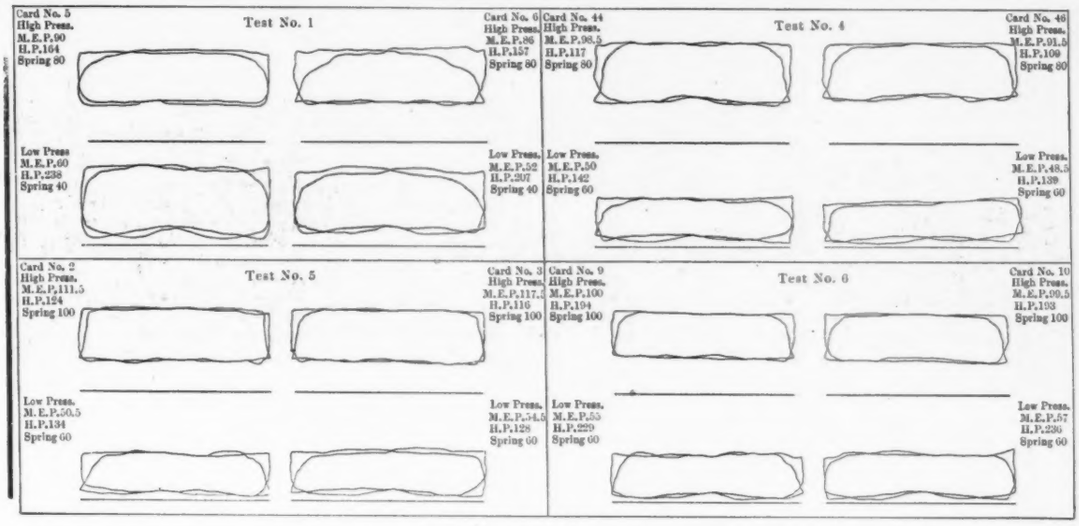


FIG. 8.—INDICATOR CARDS.

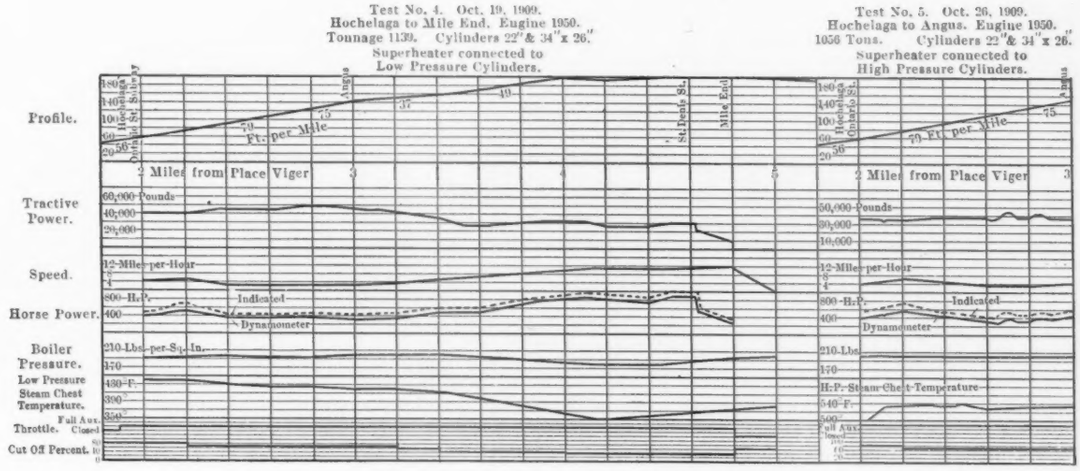


FIG. 9.—DYNAMOMETER CAR RECORD.

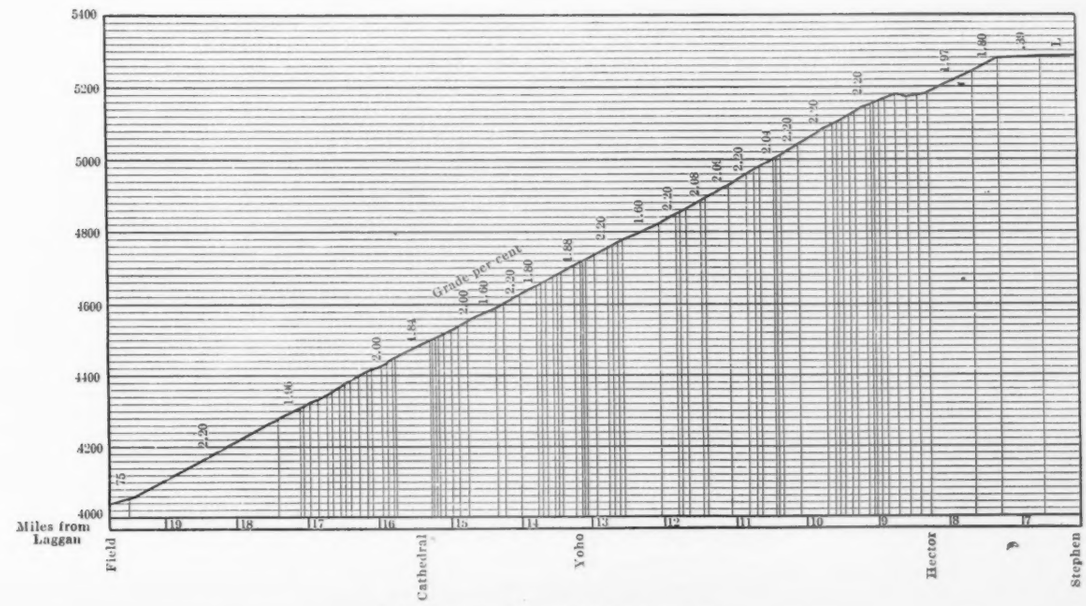
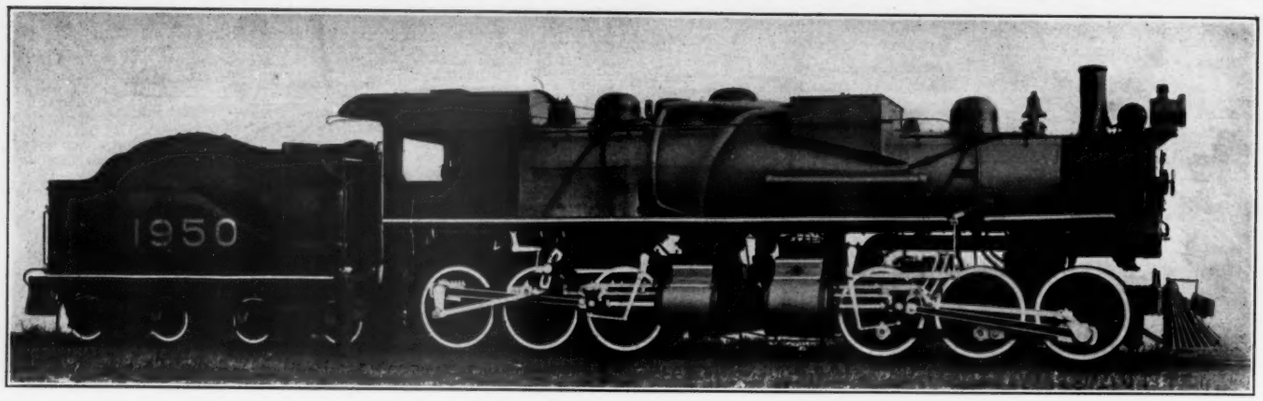


FIG. 10.—PROFILE—FIELD TO STEPHEN.



MALLET ARTICULATED LOCOMOTIVE—CANADIAN PACIFIC RAILWAY.

The decrease in the measure of steam in the low pressure cylinders, due to the position of the superheater, is well illustrated in this test by comparing it with No. 1, in which the amounts were very nearly equal.

As the tests just described indicated that the best results would be obtained with cylinders 23¼ in. x 26 in. on the high pressure engine, and 34 in. x 26 in. on the low, and with the high pressure cylinders taking steam from the superheater, the locomotive was put into regular service in the Rocky Mountains, pushing on the grade eastward from Field to Stephen.

The profile of this section is shown by Fig. 10; the maximum grade is 2.2%, and there are two spiral tunnels of 2,890 ft. and 3,200 ft. long, having a radius of 573 ft.

The regular locomotives working on this and similar grades in the Rocky Mountains have general dimensions as follows:

Type	2—8—0
Class (Ry. Co.'s)	M—4
Cylinders	21 in. x 28 in.
Driving wheels, diameter	58 in.
Boiler pressure	200 lbs.
Weight on drivers	168,000 lbs.
Weight, total	185,000 lbs.
Tractive power	36,200 lbs.
Factor of adhesion	4.65

That used in regular service is known as "Canmore Coal," and is mined in the Rocky Mountains; it is much finer than the Dominion coal and very dusty and must be thoroughly wet down before firing, otherwise a considerable percentage goes up the stack in the form of cinders; it is rather higher in fixed carbon than the former, but the heat value is about the same.

The locomotive steamed as successfully with the "Canmore coal" as it did with the Dominion coal, although adjustments were necessary in the smokebox diaphragm and draft pipes, the diameter of the exhaust nozzle with both coals being 4¾ in.

Fig. 11 is the log of what may be considered a representative trip of the locomotive in regular service on the Field Hill, and is chiefly interesting as proving that the boiler is of ample capacity to supply steam to the cylinders; it also shows the temperatures and pressures in the high and low pressure steam chests. The maximum temperature shown in the high pressure steam chest was 540 degrees, or 153 degrees superheat. An average of a number of trips shows a temperature of 535 degrees, or 148 degrees of superheat, which is reached soon after a train is started and remains practically constant, irrespective

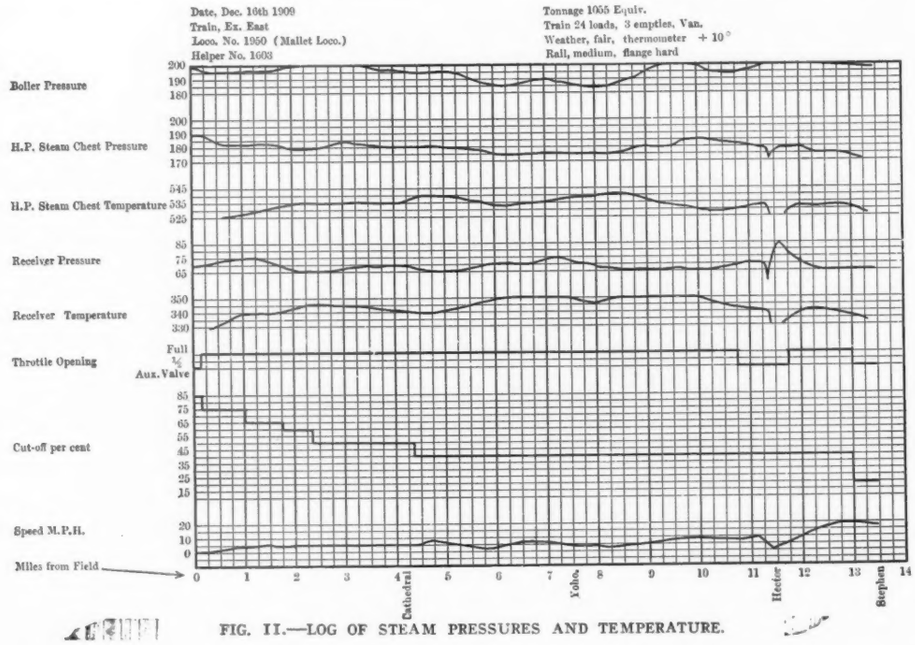


FIG. 11.—LOG OF STEAM PRESSURES AND TEMPERATURE.

Their full rating in summer is 424 tons, and on the same basis the Mallet locomotive should handle 660 tons, which it does without trouble, and has also taken up 700 tons, which may be considered the maximum tonnage for this grade.

Dominion coal was used on the tests made at Montreal; this is a friable, rather fine coal, and an average of the analyses of 25 samples gives the fixed carbon as 55.71% and the heat value 13,729 B. T. U.

of boiler pressure, cut-off, throttle position, or speed.

The maximum temperature shown in the receiver pipe was 350 degrees, and the average was about 345 degrees, and as the pressures ranged from 60 lbs. to 75 lbs., this would give from 38 degrees to 25 degrees superheat in the receiver.

The amount of condensation in the low pressure cylinders is very small and the cylinder cocks are closed after a few revolutions, which, of course, tends to decrease the water consumption.

As the locomotive has not been in service sufficiently long, no figures are available as to the cost of maintenance, but it is to be expected that as there is practically double the amount of machinery, this will be somewhat higher than on the consolidation locomotives in the same service.

The operating costs will be slightly higher when considered on a locomotive mile basis; the same crews do the work for the same wages, but more lubricant, waste and sand must of necessity be used, and the cost of wiping and cleaning will also be higher.

On a ton mile basis, which is the fairest comparison for operating costs, it will be lower, due to the greater tonnage hauled, which, it is considered, together with the saving in fuel, will show considerable economy in favor of the Mallet locomotive.

GENERAL DATA.	
Gauge	4 ft. 8½ in.
Service	Pusher
Fuel	Bituminous Coal
Tractive power	57,400 lbs.
Weight on drivers, working order	262,000 lbs.
Weight, total in working order	262,000 lbs.
Weight of engine and tender, working order	391,000 lbs.
Wheel base, front engine	10 ft. 4 in.
Wheel base, rear engine	10 ft. 4 in.
Wheel base, total engine	35 ft. 2 in.
Wheel base, engine and tender	60 ft. 7 in.
RATIOS.	
Weight on drivers ÷ tractive effort	4.57
Tractive effort × diam. drivers ÷ equivalent heating surface*	975
Equivalent heating surface* ÷ grate area	59
Weight on drivers ÷ equivalent heating surface*	77
CYLINDERS.	
Diameter and stroke, H. P.	23¼ x 26 in.
Diameter and stroke, L. P.	34 x 26 in.
VALVES.	
Diameter and kind, H. P.	11 in. Piston
Diameter and kind, L. P.	12 in. Piston
WHEELS.	
Driving, diameter	58 in.
Driving axles, size,	Main 9½ x 12 in; others 9 x 12 in.
BOILER.	
Style	Radial stayed, wagon top
Working pressure	200 lbs.
Firebox, length and width	120 x 69⅞ in.
Firebox, water spaces	Sides 4½, Throat 5, Back 3½ in.
Firebox, thickness of sheets	5/16, ⅜, ½ and 7/16 in.
Tubes, Number and diameter in front section	281—2 in. O. D., 12—2¼ in. O. D.
Tubes, length in front section	96 in.
Tubes, number and diameter in rear section	289—2 in. O. D.
Tubes, length in rear section	109 in.
Heating surface, tubes	2605 sq. ft.
Heating surface, firebox	180 sq. ft.
Heating surface, total	2785 sq. ft.
Superheating surface	420 sq. ft.
Equivalent heating surface*	3415 sq. ft.
Grate area	58 sq. ft.
TANK.	
Tank, kind	Semi-Water Bottom
Frame, sills	Centre 13 in., Sides 10 in.
Trucks, kind	Equalizer
Wheels, diameter	34 in.
Axles	5½ x 10 in.
Water capacity	5,000 Imp. Gallons
Coal capacity	12 tons

*Equals total heating surface + superheating surface × 1.5.

WELFARE WORK.

In the year 1908 the International Harvester Company spent about $100,000 in its welfare work. This year it will probably spend a somewhat larger sum. This includes a system of profit sharing, insurance covering sickness, accident and death, also old-age pensions.

The company has been criticised by managers of other companies for making the plan too liberal and attractive. There is no doubt of the truth of this criticism in so far as the cost goes. No concern has ever put out plans that involved the application of so large a percentage of its profits to such plans. But the Harvester Company did not do this out of pure philanthropy. It had no intention of passing around a hat full of money, that employees might help themselves. It went into these enterprises in a purely business spirit, believing that the plans would so knit its vast organization together, would so stimulate individual initiative, would so strengthen and develop the *esprit de corps* of the organization as to make it possible for the company to increase its business and its earnings.

So far the company has every reason to congratulate itself on the result. In all parts of the company's business, at home and abroad, in the office force, in the factories, in the sales department, everywhere, the average interest of the individual in the business is greater than formerly. The saving of the waste here, there and everywhere is noticeable. The employees throughout the organization are vying with one another more and more to improve their respective branches of the business. This means profits for the stockholders, means extra compensation in various ways for the employees; in short, means co-operation that is real, that is beneficial to one and all.—*George W. Perkins before the annual meeting of the National Civic Federation.*

FACTORS OF SAFETY FOR LOCOMOTIVE BOILERS.

In the third annual report of the New York Public Service Commission, Second District, the inspector of locomotive boilers, Garland P. Robinson, proposes the following permissible factors of safety for boilers of different ages:

		Factor.
1.	Boilers with butt seams, under 30 years	4
2.	Boilers with lap and cover seams, under 20 years	4
3.	Boilers with lap and cover seams, 20 to 30 years	4¼
4.	Boilers under 20 years old with plain lap seams	4¼
5.	Boilers with plain lap seams, 20 to 30 years	4½
6.	Boilers 30 to 40 years old	5
7.	Boilers over 40 years old	to be condemned

The data for 7,724 boilers have been tabulated on the basis of these factors of safety with the following results:

NUMBER OF BOILERS WHICH DO NOT MEET THE PROPOSED STANDARD.	
Number of boilers, butt seams under 30 years, factor less than 4	60
Number of boilers, lap and cover seams under 20 years, factor less than 4	54
Number of boilers, lap and cover seams 20 to 30 years, factor less than 4¼	47
Number of boilers, lap seams under 20 years, factor less than 4¼	175
Number of boilers, lap seams 20 to 30 years, factor less than 4½	108
Number of boilers, any seams 30 to 40 years, factor less than 5	13
Number of boilers over 40 years	2
Number of boilers of unknown age	6
Total	465

In order to comply with the proposed standards the following reductions would have to be made in pressure:

Number of boilers to have pressure reduced 5 pounds	39
Number of boilers to have pressure reduced 10 pounds	95
Number of boilers to have pressure reduced 15 pounds	140
Number of boilers to have pressure reduced 20 pounds	71
Number of boilers to have pressure reduced 25 pounds	32
Number of boilers to have pressure reduced over 25 pounds	80
Total	457

In commenting on this the report states:

"The proposed standards above given have been submitted to all companies and their full criticism requested. Replies from all have been received. The suggestions meet with the approval of the majority of the roads, and while they are criticised by others, it appears probable that no standards could be fixed which would not meet with fully as much opposition. In the matter of lap seam boilers, for instance, one large road states that no additional factor of safety is required beyond that necessary for boilers with modern seams; and another equally prominent road states that lap seams should be prohibited by law.

"Most of the companies have agreed to comply with the suggestions of the Commission, and to condemn or strengthen doubtful boilers or to reduce pressures. The company which happens to have the largest proportion of locomotives which will be affected by the proposed standards, and which will therefore be subjected to the greatest expense for any changes which may be decided upon, writes:

"'The minimum factors of safety as indicated by you seem to be reasonable, and there is no engineering data or authority that will justify any recommendation for a lower factor than that suggested by the Commission.'"

GAS ENGINE DEVELOPMENT.—The development of the large gas engine within the last few years has been exceedingly rapid. It was only nine years ago that a 600 horse-power engine exhibited at the Paris Exposition was regarded as a wonder, but to-day four-cycle, twin-tandem, double-acting engines of 2,000 to 3,500 horse-power can be found in nearly all up-to-date steel plants, and there are installations in this country containing several units rated at 5,400 horse-power each.—*From Bulletin 416, United States Geological Survey.*

LOCOMOTIVE TERMINALS

A DISCUSSION OF THE ARRANGEMENT, DESIGN, CONSTRUCTION AND OPERATION OF LOCOMOTIVE TERMINAL FACILITIES TO OBTAIN THE GREATEST EFFICIENCY.

PART III.

Reporting Work.

Ordinary running repairs at practically all terminals are made on the basis of the written reports of the engineer who has brought the locomotive in, and of the inspectors who have inspected it. These reports, for obvious reasons, should be written, and the proper form of blank be filled out, to accomplish the best results.

When locomotives were smaller and less complicated the reports for repairs were usually made on what practically amounted to a blank pad on which was written a memorandum of what needed attention. Under modern conditions, however, it often happens that a report of this form would be of considerable length, covering several sheets, which would be difficult to record and file, to say nothing of the difficulty of deciphering some of the handwriting. It is the custom on some roads to have a printed sheet where practically all of the items that might possibly need reporting are given and it is necessary for the engineer or inspector to simply make an X after the item that requires attention.

One of the illustrations shows the front and back of a sheet of this kind, in use on the New York Central & Hudson River Railroad, which answers the purpose very well. The instructions printed on the back of this sheet show how it is used.

In connection with the description of the inspection pit and instructions to inspectors on the Pennsylvania Railroad given in the previous issue, the form MP-62 used by both the inspectors and engineers was illustrated. This blank answers the purpose under the conditions described very well, since each report covers only a very small part of the locomotive and there are five or six separate reports sent in at once, none of which could be very extensive. At points, however, where but one inspector is used and the engineer is required to very carefully go over the whole locomotive himself such a form would not be large enough.

In the Pennsylvania scheme the MP-62 reports, on arrival at the engine house, are removed from their carriers by the work clerk, who in all cases is a thoroughly practical mechanic, and the items thereon are transferred to other blanks, each separate job, or a number of minor jobs, being put on a single card. These cards are given to the work distributor, who in turn delivers them to the foreman in charge of each class of work. One of the forms used for this purpose in the engine house is illustrated. The piece work card differs from this very slightly. The column on the extreme right is for use in case a man is temporarily taken off from a piece of work on which he is engaged. Under such conditions the time is noted when he was taken off the job and he surrenders his card to his foreman, receiving in return another card. At no time may a workman have more than one card and that referring only to the work upon which he is engaged. On the other hand, the cards retained by the foreman always show the work that is not assigned and that which has been temporarily suspended. When the job is completed and has been inspected, the card is returned to the work clerk in the office, who checks it and fills in the total amount and files it in a case kept for that purpose.

In order to prevent the necessity of writing out each item by the work clerk, an experimental card is being tried at some of the engine houses on the Pennsylvania, where piece work is in force, on which the separate items are printed in a column so arranged that a punch mark can be made opposite each. In using the card the work clerk simply punches the items requiring attention, as given by the MP-62 report, instead of writing them out. The subforemen also possess punches for indicating the jobs that develop while the work is being done. The piece work prices are printed on this card, and when it is returned, the record is complete and requires very little labor for recording. The illustration shows the face of one of these cards as a sample of the method. The back of the card has a double column of items similar to the single column on the face. There is a different card for each different class of work.

It will be noticed that in all of these cases the foreman is required to sign his name to the card and a record is kept of the

SYNOPSIS.

M. P. 142 B

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

DAY WORK CARD

7 19 1909
N 8 x 3

SERIAL No. OF CARD _____ ISSUED MO. _____ DAY _____
No. OF SHOP _____ COMPLETED MO. _____ DAY _____
ISSUED TO _____ NUMBER OF OPERATOR _____

CHARGE	PIECES	OPERATIONS	Rate per Hour	AMOUNT		TIME	
						1st ON	
						1st OFF	
						2d ON	
						2d OFF	
						3d ON	
						3d OFF	
		CORRECT ..... FOREMAN ..... TOTALS					

WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD.

NAME	NO. OF OPERATOR	DATE AND HOUR														TOTAL HOURS	Rate Per Hour	AMOUNT	

CORRECT ..... Foreman TOTALS

BACK OF WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD.

M. P. EXPERIMENTAL 1-8

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

2430. 8-30-09
8½ x 5½

SERIAL No. OF CARD _____ ISSUED _____
No. OF SHOP _____ CHARGE _____ CLASS _____ DIV. COMPLETED _____

NAME	No.	Rate Per Hour	DATE	1st	2d	3d	4th	5th	TOTAL HOURS	AMOUNT	
			ON								
			OFF								
			ON								
			OFF								
			ON								
			OFF								
CORRECT ..... Foreman			INSPECTED / NOT INSPECTED ..... Gang Leader					TOTALS			

PIECE WORK PRICES ARE PRINTED IN THESE COLUMNS.

OPERATIONS

CROSSHEADS
ARM, EXT. OVER, NEW, NO. _____
BLOCK, PER SIDE TO GUIDE
CROSSHEAD WHEN LOC. FROM PISTON ROD
GIB FIT TO SHOE
GIB FIT TO SHOE AND LINED
GIB FIT TO SHOE AND LINED, NEW GIB
KEY, NEW FIT
KEY, OLD FIT
KEY, OUT AND IN
KEY SAFETY PIN RENEWED
KEY TIGHTENED
KEY, SAFETY PIN
PIN DOWEL PIN PUT IN
PIN SAFETY PIN
PIN TIGHTENED
PIN TRUED BY HAND
PISTON ROD CUT & COUP. AT CROSSHEAD
SHOE BOLT
SHOE BOLT TIGHTENED
SHOE BOLT FILED AND FIT BY HAND
SHOE BOLT HOLE REAMED
SHOE OFF & ON CENTER, NOT INC. BOLTS
SHOE OIL CELLAR OR CUP SPONGED
SIDE PLATE LINER RIVETED ON
SIDE PLATE FIT ON, NEW
SIDE PLATE STUD
SIDE PLATE STUD DRILLED OUT, ONE
SAME, EACH ADDITIONAL
CYLINDERS
COCK
COCK BACKED OUT WHEN BROKEN OFF
COCK CLEANED OUT
COCK DRILLED OUT
COCK HOLE RETAPPED
COCK REACH ROD, BACK SECTION
COCK REACH ROD BELL CRANK
COCK REACH ROD, FRONT SECTION
COCK REACH ROD LEVER
COCK REACH ROD LEVER GUARD
COCK REACH ROD OR SLIDE, PER SIDE
COCK ROD STRAIGHTENED & SET, PER SIDE
COCK SHAFT
COCK SHAFT BEAM & FILED & FIT TO FRAME
COCK SHAFT LEVER
COCK SHAFT STRAIGHTENED OR RESET
COCK SHAFT BEARING THUS... BOTH SIDES
COCK THAWED OUT, PER SIDE
COCK VALVE
COCK VALVE SEATED
CYLINDER BORED OUT, FIRST CUT
CYLINDER BORED OUT, EACH ADDIT. CUT
CYLINDER, REBORING COUNTER BORE
CYLINDER, 3-PIECE, INC. HOLES REAMED, COMPLETE
HEAD, BACK, AFTER GUIDES ARE DOWN, ONE SIDE
HEAD, BACK, AFTER GUIDES ARE DOWN, ALL OTHER CLASSES
HEAD, BACK, BUSHING
HEAD, BACK, CASING
HEAD, BACK, CASING FIT TO CYLINDER
HEAD, BACK, CASING TIGHTENED
HEAD, BACK, STUD DRILLED & RETAPPED
HEAD, BACK, STUD DRILLED & RETAPPED
HEAD, BACK, TIGHTENED COMPLETE
HEAD, PKR., BK., DIA. E, F, G, REA

PCS. OUT IN

EXPERIMENTAL WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD

workman who performs the work. The files are usually made under engine number heads, so that it is a very simple matter to trace the workmanship to the workman.

The scheme for reporting, recording, distributing, and filing the work reports on the Lake Shore & Michigan Southern Railway was very fully described in the article on "Organization," which appeared in the December, 1908, issue of this journal and the following description is reprinted from that article:

When an engineer comes in off his run he verbally reports the work which is necessary on the engine to a clerk at the work report office. The clerk writes the report in a work report book and the engineer reads it, and if correct, signs it. In this way

the reports are always kept clean and legible. The clerk makes out the work slips from the report book on a form about 3 x 5 in., similar to the one shown in the illustration; a separate slip is made out for each job. When the work cards have been made out, the clerk marks the work report in the book O. K., with the figure 1 or 2 underneath, showing that the items have been copied on work slips; 1 indicates that the cards have been made out by the day clerk and 2 by the night clerk.

The cards are placed on the engine foreman's desk along with all incomplete work reports (work reported but not done when engine was last in the house) for that particular engine; these latter cards are taken from the incomplete pigeon-hole, of the engine in question, in the file case.*

The passenger work cards are turned over to the passenger engine foreman and the freight and switch engine work cards are given to the freight engine foreman. These in turn distribute them to the various gang foremen or workmen, as the case may be, and when the work is completed, or at the close of the work period, receive them back. The engine foremen distribute and receive the cards so that they may have an exact knowledge of all of the work reported and in order that they may promptly report the engines for service when the work is completed.

If any of the inspectors or foremen discover unreported work, a report is made out and handed to the clerk, who copies it in the work report book, and the card is handled the same as engineers' cards.

As soon as the work has been completed the workman signs and dates the cards on the face, in a place provided for that purpose, and returns them to the gang foreman. If, for any reason such as lack of material, too short time, or the engine not dumped, the work reported cannot be attended to before the engine goes out, the foreman having the work card will make a note on the back of it to that effect, signing his name and date. This incomplete work card is then filed in the incomplete pigeon-hole, under the number of the engine. When the engine returns to the engine house the incomplete cards are taken from the pigeon-hole and handled as new cards. If the work has been done at the other end of the run the card is signed and handled in the usual manner.

A distinction should be made between cards for work, which upon inspection by the gang foreman is found to be in good condition, and cards for work, which, although necessary to be done, was not finished before the engine was allowed to leave this point. Cards of the first class refer to work which in the judgment of the engine foreman is in good condition and need not be done. Such cards should be signed on the face by the engine foreman, giving the date and stating that the work reported is not necessary. These cards are then ready to be filed as "finished" work.

Cards of the second class are for work to be attended to on the return of the engine; such cards should be signed and dated on the back along with a brief explanation why the work could not be done before the engine left the house. These cards are "unfinished" work reports and should be so filed. The gang foreman returns all completed cards to the office as soon as the work is finished and the incomplete cards at the close of the work periods, or when the engine leaves the house. If the engine is still in the house at the close of the work period, all incomplete cards for work which may not be done are turned over to the incoming gang foreman. The report clerk should file all finished cards as soon as possible and hold over the unfinished ones.

At the close of each month all finished cards are taken from file all finished and hold-over or unfinished cards as soon as possible.

FORM M. P. 200A.

New York Central & Hudson River Railroad Co.
MOTIVE POWER DEPARTMENT.

REPORT OF CONDITION OF ENGINE AT END OF TRIP.

Report of condition of engine No. ..... after careful inspection on arrival at ..... M. ..... 190 ....

Engine is in good condition, with the exception of the items marked X in column headed "Eng'r" and items reported under heading "other defects."

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
	HOT BEARINGS.				
1	Journals				
2	Pins				
	AIR BRAKE EQUIPMENT.				
3	Air Brake Equipment				
4	" Pump				
5	" Signal Equipment				
6	Brake Beams & Shoes				
7	Driver Brakes				
	BOILER				
8	Blow off Cocks				
9	Brick Arch				
10	" " Tubes Leaking				
11	Check				
12	Chain Cab Defective or Leak'g				
13	Crown Sheet Leaking				
14	Exhaust Pipes "				
15	Firebox "				
16	" Doors "				
17	Flues "				
18	" Stopped				
19	Foaming				
20	Front End Arrangement				
21	Gage Cocks				
22	Grates				
23	Grate Shaker Rigging				
24	Injectors and Pipes				
25	Mud Ring Leaking				
26	Safety Valve				
27	Side Sheets Leaking				
28	Stay Bolts "				
29	Steam Pipes "				
30	Throat Sheet "				
31	Throttle "				
32	" Packing "				
33	" Lever				
34	Water Glass & Cocks				
35	Whistle & Rigging				
	MACHINERY.				
36	Bolts Loose in Crosshead				
37	" " " P'k'r boxes				
38	Crank Pin Loose				
39	" " " Collars				
40	Crosshead Key & Pin				
41	Cylinder Leaking				
42	" Cocks & Rigging				
43	" Head Leaking				
44	" Packing Blowing				
45	Driving Boxes				
46	Eccentrics				
47	" Straps & Bolts				
48	Frame Broken				
49	" Bolts " or Loose				
50	" Splices Working				
51	Guides Loose				
52	" Lost Motion				

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
	MACHINERY—CON.				
53	Knuckle Joint Pins				
54	Lost Motion in Link Motion				
55	Main Rods				
56	Pack Journals				
57	Piston Head Loose				
58	" Rod "				
59	" " Broken				
60	" " Packing				
61	Pounds in Boxes				
62	" in Wedges				
63	Relief Valves				
64	Reverse Lever				
65	Rocker Boxes				
66	Rod Bushings				
67	Steam Chest				
68	" Gage				
69	Strap Bolts				
70	Transmission Bar & Pin				
71	Valves Blowing				
72	" out of Square				
73	Valve Rod Packing				
74	Wedges Set up				
	MISCELLANEOUS.				
75	Ash Pan				
76	Bell Ringer				
77	Blower Pipe & Valves				
78	Cab Repairs				
79	Cellar Bolts				
80	Coupler Defective				
81	Headlight				
82	Lost Motion—Engine & Tender				
83	Lubricator				
84	Marker Lamps				
85	Oil & Grease Cups Filler Apply				
86	" " " Plugs				
87	" Pipes				
88	Pedestal Bolts				
89	Pilot				
90	Sander & Sand Pipes				
91	Sharp Flanges on Tires				
92	Springs—Bailer				
93	" " Driver				
94	" Engine Truck				
95	" Tender & Trailer				
96	" Eq'liz'rs & Hangers				
97	Steam Heat Gage				
98	" " Hose & Pipes				
99	" " Regulators				
100	" " Valves				
101	Tank Hose				
102	" Leaks				
103	" Valves				
104	Tender Truck Brasses				
105	Tires Loose				
106	Water Scoop				

Saftey valve lifts at..... lbs. Safety valve sets at..... lbs. Reservoir pressure..... lbs. Train line pressure..... lbs.

OTHER DEFECTS: .....

.....

Engineman.

FACE OF ENGINEER'S AND INSPECTOR'S REPORT CARD—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

Supervision.

In practically all of the systems for assigning work by means of cards it is required that the foreman of the gang doing the work shall sign the card, before it is turned in, as a record that he has inspected the finished work and found it satisfactory. Of course, there is much work done around a roundhouse that it would be impossible to inspect, but inasmuch as the workman's name is also on the card it is easy to soon discover an unreliable man.

NEW YORK CENTRAL LINES

FORM 2668. S. 9657. 200m. 8-08. (GES 85112)

LOCOMOTIVE WORK CARD. No.....

Eng. No.	Eng'r.....or Insp.....	Place and Date

Work Performed by	Date

ENGINE HOUSE WORK REPORT CARD—L. S. & M. S. RY.

* These file cases consist of pigeon holes 3⅛ in. wide and 3 in. high, one for each engine, sub-divided by tin slides so that the upper section, ¾ in. high, may be used for incomplete work cards, while the lower part, 2¼ in. high, is used for finished work reports.

These files are in the office of the clerk, in which no one is allowed to enter but the clerk and the engine-house foreman. The engineers' reports are dictated through a window. The hostler reports the engine numbers as soon as the engines are placed in the house or on storage track, so that the clerk can immediately place the incomplete work reports, if there are any, on the foreman's table.

Enginemen must carefully inspect their locomotives before turned over to engine house force, or at the end of each day's work. Enginemen will be held responsible for reporting on this form all defects which can be seen by them from the outside, or observed on the road. Enginemen must make report on one of these forms whether the engine requires repairs or not, and must always fill in items "Safety Valve lifts at....." "Safety Valve sets at....." "Reservoir Pressure....." and "Train Line Pressure....." No attention will be paid to verbal reports or reports not signed by enginemen.

Items numbers 6, 13, 24, 34, 35, 40, 42, 47, 70, 77, 90, 95, 96 and 98 contain two or three items each; when reporting any of the items for any of these numbers for repairs, draw a line through the item which is in good condition and which is NOT in need of repairs.

The Engineman, to report an item in need of repairs, should place an X after the item in column headed "Eng'r," and the Inspector, to report an item in need of repairs, should place an X after the item in column headed "Insp.," thus:

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
1	Hot journal	R. M. D.	X		
93	Springs—Driving	L. F.		X	

would indicate that the Engineman had reported the right main driving journal as running hot and that the Inspector had reported the left forward driving spring in need of repairs.

When repairs have been made the Foreman or the man in charge of the work must draw a circle around the X which indicates that the repairs have been made, thus:

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
1	Hot journal	R. M. D.	⊗		John Smith
93	Springs—Driving	L. F.		⊗	W. Jones

would indicate that the hot driving journal reported by the Engineman had been repaired by John Smith, and the left forward driving spring reported by the Inspector had been repaired by W. Jones.

The following items reported under the heading "Other Defects" have been repaired:

ITEM REPORTED	REPAIRS MADE BY

When items are reported as in need of repairs and the repairs are not made, the Foreman or the the man in charge of the work must give the reasons for not making the repairs in column headed "Repairs Made By."

Reservoir Pressure.....lbs. } as found. Reservoir Pressure.....lbs. } as corrected.
Train Line Pressure.....lbs. } Train Line Pressure.....lbs. }

Repaired at _____

Repairs completed _____ 190__ at _____ M.

Repairs made by _____
Name of workman in charge of work

Inspected by _____
Engine Inspector.

Air Brakes Inspected by _____
Air Brake Inspector

Approved by _____
Engine House Foreman.

NOTE:—The workman in charge of the work, Engine Inspector and Air Brake Inspector will sign this report and hand it to the Engine House Foreman, who will approve same and forward to the Master Mechanic, or the Division Superintendent of Motive Power.

BACK OF ENGINEER'S AND INSPECTOR'S REPORT CARD—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

It is the custom in some engine houses where piece work is in force to have a certain number of day workers and to use them for all work which cannot be thoroughly inspected, the piece work jobs being only those that are not concealed.

Ample supervision of engine house forces is of an importance equal to that of ample facilities. The work at this point does not generally attract the highest class of workmen, and it is often necessary to use men that are not thoroughly trained and who need considerable instruction. Unexpected difficulties and annoyances are very numerous, in all of which cases, if there is some one available who has authority and time, the work will proceed with much greater smoothness and rapidity. It is a great mistake to have too few foremen in an engine house. While they appear on the payrolls as non-productive labor, they are really the most productive class of men employed and even in indirect ways are often enabled to save the company the amount of their monthly salaries in a day or even in a few hours. In selecting engine house subforemen it is very advisable that men who have been trained in engine house work be selected. It is, of course, well that they should have had other experience, but the peculiar conditions of the handling of running repairs need special training in that line.

REMARKS—Why Not Done	Foreman	Date

BACK OF ENGINE HOUSE WORK REPORT CARD—L. S. & M. S. RY.

Work to Be Done.

It is impossible to formulate a rigid rule for what work shall be done in engine houses and what shall not. It is profitable at some points to make fairly heavy repairs in an engine house, work which will sometimes occupy as much as a week or ten days. Again, some engine houses are not permitted to do any heavy repairing and are not equipped for doing much machine work. Where the house is a long way from a repair shop and is handling a large amount of power it must be to a considerable extent self-supporting. Again, where it is located adjacent to a heavy repair shop it is usually considered that it should depend upon the shop for all the heavy work. The advisability of the latter arrangement is open to question.

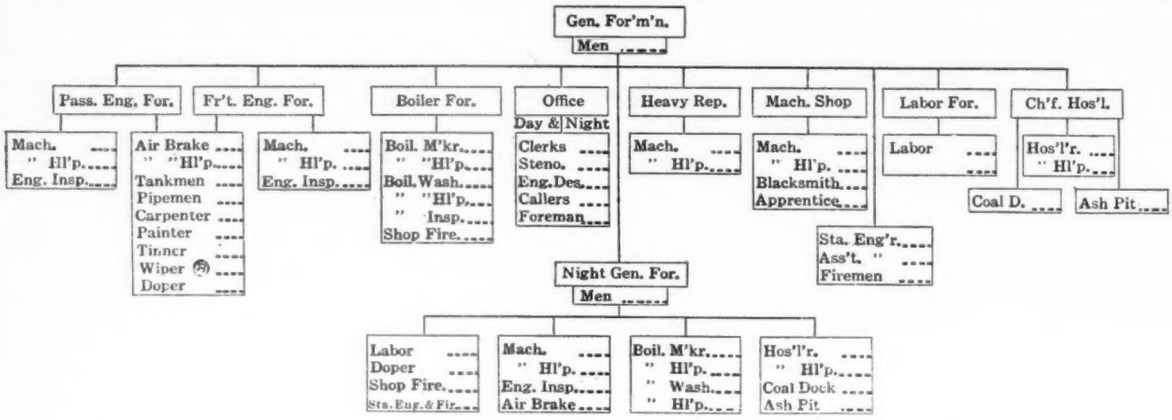
Under average conditions it may be said in general that facilities should be provided for taking care of all work that does not require the actual renewal of some major part which would require machining and fitting. It probably is not advisable, as a general thing, to arrange for the renewing of tubes in an engine house, although this is sometimes done. All boiler repairs which require the renewal of any large part will under ordinary conditions keep the locomotive out of service a sufficient length of time to make it advisable to send it to the shop where other repairs that may not be immediately necessary can be made while it is laid up. Engine houses should be provided with facilities for removing the wheels, for turning the tires—unless standard wheel centers are in use when they can be changed instead of turned—for facing shoes and wedges, refitting driving boxes, renewing rod brasses, renewing cross head gibs, patching or welding frames as a temporary repair, doing all required repairs to the brake rigging, renewing bushings on the valve gear, renewing eccentric straps, facing off valve seats and all work of this character.

Where the locomotives are thoroughly standardized it is possible to supply the engine houses with parts which are already finished to standard dimensions and in such cases much more extensive repairs can be made in the engine house than would be otherwise advisable.

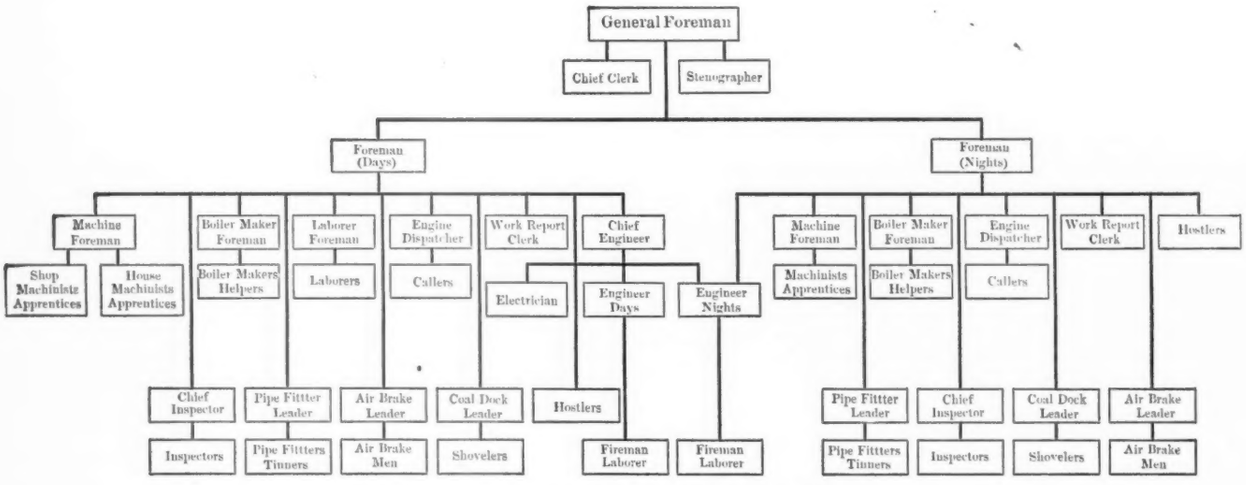
All the engine houses built in the last 8 or 10 years are provided with drop pits or drop tables for removing wheels and in the case of the Ashtabula engine house of the Lake Shore Railway, at least, an overhead crane of a capacity sufficient to lift a locomotive is provided. At this place all of the wheels can be removed and the locomotive be placed on blocks in a convenient position for making other repairs in about five minutes after the rods and pedestal binders have been removed.

Machine Shop.

At all terminals turning more than 100 locomotives per day and in some cases at those turning less than this, a complete machine shop should be provided. This does not mean that it necessarily should be extensive or that all of the tools that are found in a repair shop should be included, but means that there should be at least one of each class of machine that work of this character might require. A driving wheel lathe of a capacity to take the largest wheels is very essential if standard centers are not in use, when it will probably be advisable to turn all tires at the



ORGANIZATION CHART FOR A LARGE LOCOMOTIVE TERMINAL—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.



ORGANIZATION OF FORCES IN A LARGE ENGINE HOUSE.

main repair shop. A planer of a size sufficient to take in a large frame brace and also suitable for shoes and wedges will be required; a lathe large enough to swing a rocker arm and probably two other sizes of lathes, one being intended for bolt work and the other of possibly 18-in. swing for general work will answer the requirements for that equipment; a medium size shaper and one radial drill; a vertical drill, a bolt cutter, pipe threading machine and cut-off saw will complete the usual tool equipment with the exception of a boring mill, which is probably one of the most important tools to place in an engine house. An hydraulic press of a size suitable for driving box brasses and a portable crank pin press should also be provided.

Jib cranes, air hoist trolleys, etc., for convenient handling of parts that require machining, will, of course, prove as valuable here as in a larger shop. The tool room should have a very complete equipment so far as various sizes of tools are concerned. It is sometimes surprising to discover how much money is lost through the inability to use a locomotive on account of the absence of a certain size of drill or reamer that is required, or by an engine failure on the road due to makeshift methods that have been compulsory on the part of the roundhouse force for the same reason. A locomotive broken down on the road will very soon lose enough money to provide a complete outfit of drills and reamers for the engine house.

A forge shop equipped with at least one good-size power hammer and a number of open forges will, of course, be found necessary. Under normal conditions no regular carpenter shop would be provided or required.

In a number of the later engine houses a narrow gauge industrial track has been set into the concrete floor all around the outer circle beyond the engine stops. This track is provided with turntables and switches, so that it extends into the various shops, store house and the scrap bin, and in some cases alongside the drop pits. Small push cars are operated upon this track and all heavy transporting is done by means of it.

Organization.

In no single way, or in fact in no combination of ways, can the cost of maintaining the locomotives in service be reduced as much as by means of a sound and thoroughly efficient organization. This feature is really very little understood on some railroads and the wonderful results that will follow its introduction are realized only by those who have discovered it by experience.

Of course, organization is a very broad term and many of the features that have been mentioned throughout these articles are part of this subject, but one of the most important features is the classification of the forces and the distribution of responsibility for results, so that, first, there is no confusion in any man's mind as to what his duties are, and, second, that his duties are within his capability. The old method where a roundhouse foreman had 100 or more workmen under him, all on the same grade, he being the only man who could sign requisitions, assign work, or clear up difficulties, was an enormously expensive one.

The accompanying illustration shows the arrangement of the forces at a large engine house where this subject has been given the closest attention, and while this exact arrangement probably is not suitable for all points, it illustrates the basic idea of the

FORM M.P. 297-A. C.H.S. 11-12-09-10M.

New York Central & Hudson River Railroad Co.

EMPLOYMENT AND CONDITION OF ENGINES.

Engine House, 8 A.M. 19

	Total
Through Passenger	
Local Passenger	
Through Freight	
Local Freight	
Switching	
Grade or Pushing	
Work Train	
Reserve	
For Sale or to be Demolished	
Stored	
Loaned	

IN ENGINE HOUSE UNDER REPAIRS.

Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required

Ready for Service	
Total	

Engine House Foreman.

All engines giving out on the road or that have been in collision during the past 24 hours should be reported under

REMARKS:

(SEE INSTRUCTIONS ON BACK)

DAILY REPORT FORM, SHOWING CONDITION OF POWER—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

NOTICE ON BACK OF ABOVE FORM.

This form should be filled out and forwarded to the office of the Division Superintendent of Motive Power showing employment and condition of each engine assigned to the point reporting or coming under the engine house foreman. Report to be taken at 8 A. M., and to give individual engine numbers.

All engines that are assigned to regular runs, or that are in daily service, should be reported under the respective headings according to the service or class of work they are performing.

Engines to be reported as "RESERVE" are such engines as are not regularly assigned to runs or other daily service, but are being held at the engine house to be used in case of an extra, or to take the place of an engine that is disabled, or is out of service for boiler washing or inspection.

Engines to be reported as "READY FOR SERVICE" are such engines as are in regular freight or switching service, and have had the fire cleaned, have been loaded with coal and water, inspected, and have had all necessary repairs made, and are waiting call for train, or other service.

distribution of responsibility through many channels which are all combined under one supreme head. This is a straight "line" organization of the simplest kind and if properly subdivided will probably prove to be the most efficient.

Another illustration is given of the organization of a larger terminal. This is taken from the article on the "Organization of the Lake Shore & Michigan Southern Railway" which is mentioned above. It shows an almost ideal arrangement which has proven to be thoroughly practical in every way.

Miscellaneous.

In the West Springfield engine house of the Boston & Albany Railroad has been instituted what amounts to a running log. This is maintained by the day and night foremen simply for their own information and record, and while it is filed for reference it is not in any manner official. In this log are jotted down such items as one foreman thinks the other may wish to have information upon. Much of this information is, of course, recorded in the dispatcher's book. No attempt is made to make this record complete in the matter of everything that happens; only such things as may come up later are noted. The log is kept in two parts, one being the engine situation, showing what engines are ready for service, what ones are held for repairs and what engines have been put into service, where they went and with what crew. The other is items of general information. Extracts from this part of the log, kept by the night foreman, are given below.

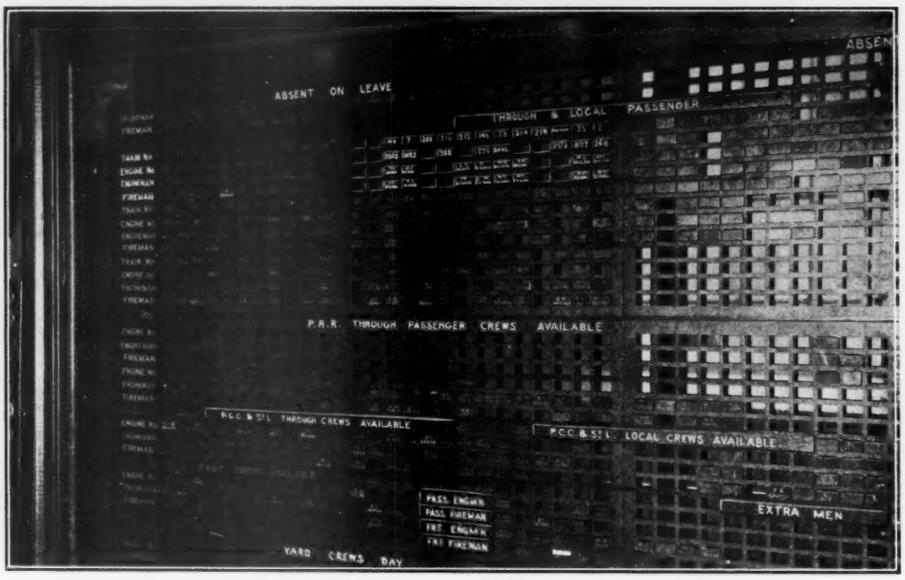
FRIDAY, JANUARY 7, 1910.

1910—Gone on No. 37—3523 off acc't flues leaking.
1151—Helping 37 with Burns and Davis.
2031—Gone on helper 43 with Makey and Devine.
3518—In on 49 returned on No. 28.
3520—In on 34—3501 returned on 70—3520 dumped, flues leaking.
3525—In on 35—3520 returned in place on No. 32.
3535—Gone to Albany light with Fox and Jones.
3506—Came up on 69—3539 in place on No. 36.
3535—Came down on Sec. 18 with Smith and Johnson.
1151—Thomas and Tobin came in on help 32.
3514—3552—Dumped acc't flues leaking.
1152—1909—3522—Coming on Pullman trains. Sec's of No. 3 can get no definite information.
2515—Gone on 1 A. M. switcher with Ripley.
2507—Gone on ice train place of 2542 that is out of service.
2524—Gone on Westfield Sus. with Kenyon.
3641—Gone on local east place of 3635 that is being held here acc't flat tender wheels.
2504—Still at Palmer. Dispt. will have eng. towed in by some helper; none out during night.
1914—Came up with Eng'r Parsons. Suppose this eng. should be held for her regular crew as their clothes and tools are locked up on eng. All the regular fast freight crews went last night except Attridge and Ward.
1905—Came up with W. White and is here for NH2.
1908—Here for B. A. 2. 1906 has not arrived yet.
Potter and Lempke are here for spare time, commences 4:30 A. M.
3506—Here for No. 6—3525 for 26—3514 for 361—1917 O. K. 3532 for 15.
3527—O. K. except left check pipe burst. 3523—Ready for a fire.
Ren's wired office last night that 2624 has very bad tender wheels, flat and shelled.
You will have to notify James and Holden that Supt. wants them at 10 A. M. to-day at his office.
Clancy will call up in a few minutes and let you know about Pullman trains coming.
2602—Has steam heat working. They will want this engine for Pullman train I think.
New fireman that you left here is here yet. Still waiting; had no freight job for him during the night. He is now in rest room.

The form used on the New York Central Lines for reporting the condition of power to the division superintendent of motive power is shown in another of the illustrations. This form is official and is forwarded each morning from all engine houses.

Posting of Blue Prints.—It is the custom on some roads to post in the engineers' room at the engine house a blue print showing all the tracks, switches and signals at that terminal. This print includes the identification mark of each tower, signal post, etc., and is found to be very valuable, especially in connection with orders that may be issued by the superintendent for the guidance of engineers in the use of certain tracks.

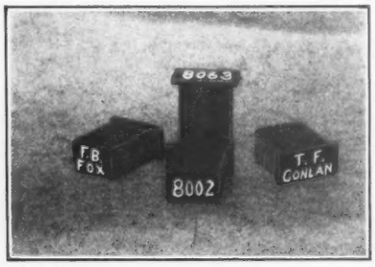
Dispatching Board.—A very successful type of dispatching board, which is in use at the Pittsburgh engine house of the Pennsylvania Railroad, is shown in the accompanying illustrations. This is placed behind glass in the partition separating the engine dispatcher's office from the enginemen's room. It is made up of a number of units of convenient size put into one frame and is thus capable of ready expansion as required. Each



DISPATCHING BOARD, PENNSYLVANIA RAILROAD AT PITTSBURGH.

of the units is made up of 5-plies of ¼-in. oak glued together with grain crossed to prevent warping. Rectangular holes, 1¼ x¾ in., are cut through the board and plugs, having flanges at one end to prevent their being pushed through too far, are inserted in the holes. These plugs bear the engine number or engineer's name as needed. The names on the plugs are large enough to be read by the dispatcher without getting up from his desk and a 12-section board has been found of sufficient size to care for the dispatching of from 150 to 200 engines per day. The titles are made up on strips which have plugs on their back, so that changes can be made readily without the scraping off of old and painting on of new titles. The illustration shows the construction of the board and plugs.

Another type of board, that has been found very convenient, is arranged in a circular frame and set behind a window in the partition between the dispatcher's office and the enginemen's room. The drum is made of sheet iron, painted, and mounted



PLUGS USED IN DISPATCHING BOARD ON PENNSYLVANIA RAILROAD AT PITTSBURGH.

so as to be easily revolved and the engine numbers and names of the crew are on tags which are hung on hooks in the proper location under the different runs. The board is provided with a circular handle at the bottom which extends through an opening into the enginemen's room and thus can be revolved to bring in view any particular run that anyone wishes to see. It can in the same manner be revolved by the engine dispatcher who marks up crews without leaving his desk.

Cans for Waste.—In a number of the better maintained houses large galvanized iron cans, about 3 ft. in diameter and 4 ft. high, are set alongside the posts between every 5th and 6th pit for the receiving of pieces of waste, sweepings from the floor and other scrap of this nature. Nothing of any value is put in these cans, which are emptied periodically on to the scrap car. Their presence to a large extent prevents the collection of miscellaneous waste material in the bottom of the pits and exerts a decided influence in keeping the house in a cleanly condition.

Soda Ash Solution.—Where soda ash is used generally it has been found that the best method is to dissolve it in large tanks, having the solution of the proper density, which is put into the tenders by means of buckets. This insures the proper amount of soda being put into each tender and is much more satisfactory than to put in the soda as a powder.

Hydrostatic Tests.—The injector for making hydrostatic boiler tests can be easily mounted upon a cart and be connected to the steam and water line connection between the pits. The boilers can in this way be tested with very little difficulty or expense.

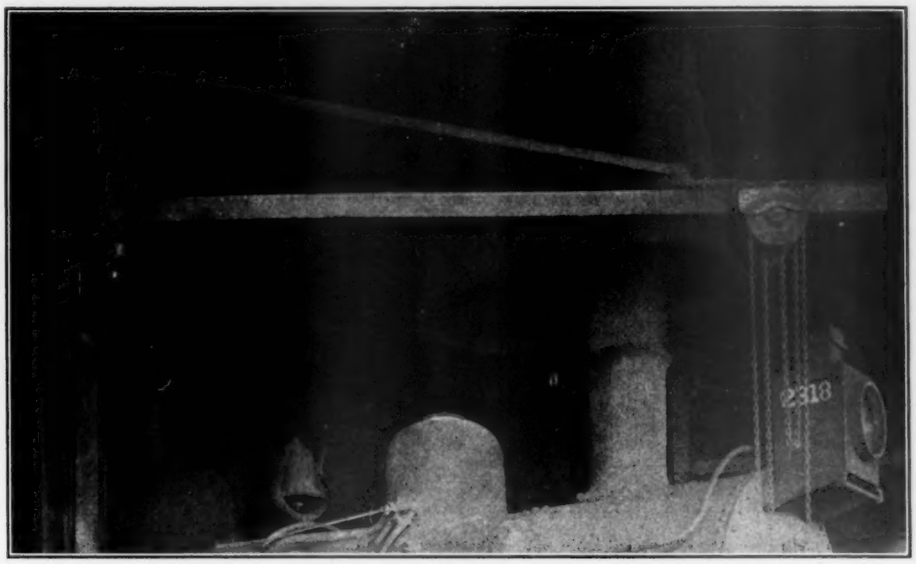
Cleaning Gang.—Three or four men, whose regular duty it is to go over the whole house the first thing every morning, picking up everything that is lying around the floors or in the pits, piling it upon a cart and afterwards salvaging the serviceable material and putting it into its proper place and dumping the refuse, will keep an engine house looking neat and clean at a slight expense. In fact, the good material which they are able to salvage, that would otherwise be lost, probably more than pays their wages.

Lamp Guards.—The guards for incandescent lamps, particularly the portables, should be very substantially made of heavy galvanized wire and provided with a strong hook by means of which they can be hung up on rods and other places around locomotives. The bottom of the guard should be flat and large enough so that the lamp can be set up on a flat surface without any danger of it being easily tipped over. Removable cross wires, forming a protection on the bottom, should be provided.

Clothes Lockers.—If the clothes lockers are in the main engine house instead of a separate building they should not be of the expanded metal type, as these permit the smoke, gases and soot to easily get inside the lockers, and soil everything therein. In such cases, of course, ventilation should be provided, but not openings large enough to allow the dirt to get inside. By far the better way is to use expanded metal lockers and have them in a separate building in connection with the toilet facilities, etc.

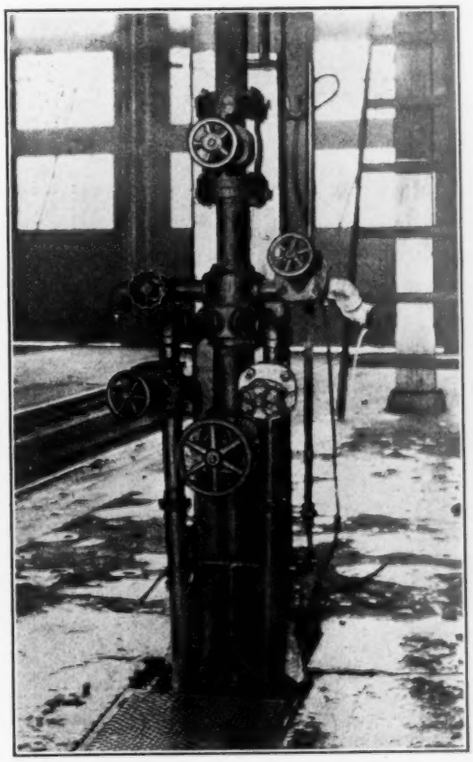
Crane on Incoming Track.—For the purpose of removing air pumps or other heavy parts, that may be shipped upon the tender of passenger locomotives, an air hoist on a jib crane extending over the incoming track leading to the turntable, or some other convenient location, has been found most convenient. The same crane, of course, can be used for loading the heavy parts that are to be shipped to the shop or other points.

Permanent Jib Crane.—No expense of time or money was spared in making the East Altoona engine house of the Pennsylvania Railroad as near perfect as possible and, among other ex-



PERMANENT JIB CRANE ON OUTER LINE OF POSTS. ONE OF THESE CRANES BETWEEN EACH TWO PITS AT EAST ALTOONA ENGINE HOUSE—PENNSYLVANIA RAILROAD.

cellent features, there are installed on each of the outer row of posts between the pits a swinging jib crane made up of I-beams and carrying a triplex chain hoist on the roller carriage supported by the flanges of the arm. These arms are long enough so that any of the heavy parts near the front end of the locomotive can be easily handled by properly locating the engine. They have been found to be one of the handiest things for an engine house. Front end rings, smokestacks, bells, steam chest



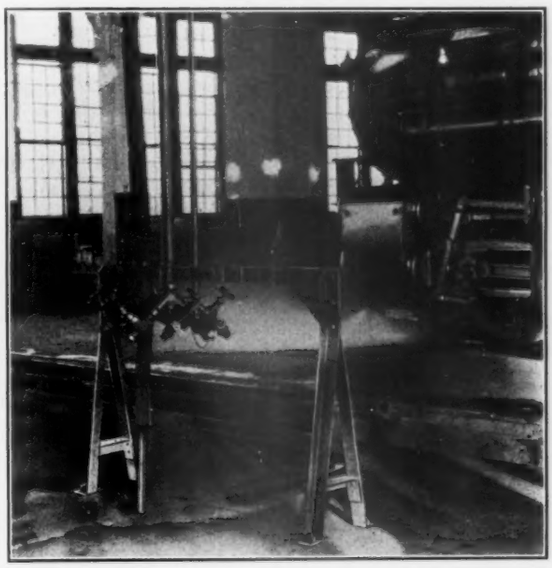
HOT WATER WASHOUT SYSTEM, MANIFOLD PIPE LINES IN CONDUIT.

covers, bumper beams, headlights, etc., are easily and quickly handled with it.

Washout System.

It can be said without fear of contradiction that every engine house in which large boilers are washed should be provided with a hot water wash out system. The saving in the time that a locomotive is kept out of service for boiler washing makes such a system very profitable to say nothing of the increase in the life and improvement in the condition of the boilers themselves.

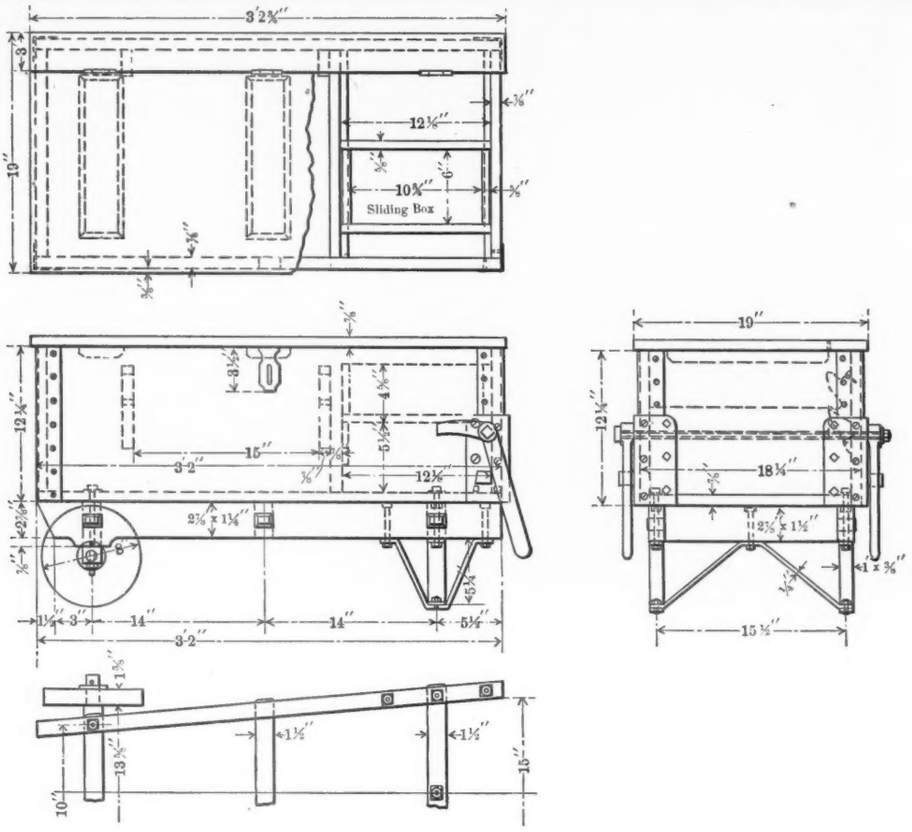
The most successful systems provide a plant consisting of the necessary drums and pumps located in a separate section of the house from which are carried the various pipe lines terminating in connections between every second pit. In some cases these pipes are carried in conduits near the outer or inner circle and have connections extending beneath the floor, which are brought up to manifolds on the posts between the pits. The conduits are covered with iron gratings so that repairs can be easily made. In these cases there is also a line carried around the roof of the house for a connection to the blow-offs on the dome which



FRAME HOLDING CONNECTIONS TO PIPE LINES OF ALL KINDS—WEST SPRINGFIELD—BOSTON & ALBANY RAILROAD.

has a connection to the same manifold. One of the illustrations shows an arrangement of this kind, which includes a large blower pipe brought up from below, a hot and cold water line and a connection on either side for the attachment of the hose.

In some other cases the pipe lines are all carried from the roof timbers at the top of the house, connections being brought down at the posts in a similar manner. The advantage of the manifold in a case of this kind is that a mixture of hot and cold water, or of steam and water, can be made so that the proper temperature is easily obtained. The disadvantage lies in the



PORTABLE MACHINIST'S TOOL BOX FOR ENGINE HOUSES.

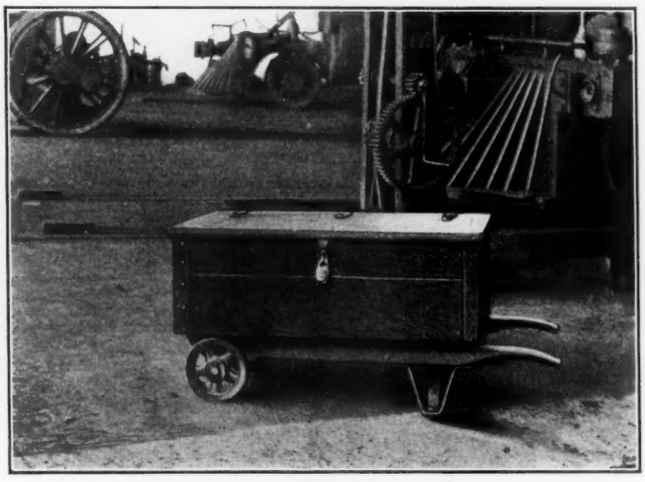
fact that the wash out water can be cooled down below the most satisfactory temperature by the man doing the washing, who finds it more convenient to handle the hose when it is not so hot. One of the illustrations shows a rack for holding the pipe terminals from the overhead line that is in use at the West Springfield engine house, where the location of the posts are inconvenient for this purpose. At the time the photograph was taken the overhead wash out system was not installed, but the places where the various pipes go on the rack are indicated. In this case no manifold is used, each pipe terminating in a Y, to which is connected two valves. The lines shown in the illustration are steam, water and air. In addition to these there has since been installed the blowing off line, the hot water wash out line and the hot water line for filling boilers. This makes a very neat and satisfactory arrangement of piping.

On account of the large amount of space required a description of several of the hot water washout systems will be delayed until a later number.

HANDY DEVICES.

Portable Machinist Tool Box.—A roundhouse machinist under modern conditions of piece work or bonus payment finds it necessary to have available a large supply of tools, more than it is possible for one man to carry in his hand from place to place. In fact, in houses where the highest efficiency is being maintained, it has been found to be good practice to equip each machinist with wrenches, jacks, etc., that in most houses are common property and stowed away in one place. In order to make it possible for a man always to have his supply of tools available and easily transportable, a tool box, which in effect is mounted on a two-wheel baggage truck, is used. This box is long enough and large enough to take in any tools that would be ordinarily required and is fitted with a substantial hasp and lock. The complete equipment of these tools is charged against each machinist, and he is held responsible for their safe keeping. Two designs of this type of tool box are shown in the illustrations, one having an ordinary wooden handle and the other fitted with iron handles, which drop down out of the way when not in use. These boxes are sometimes made of sheet metal instead of wood, although the latter is perfectly satisfactory. These boxes are also convenient for use as benches to stand upon.

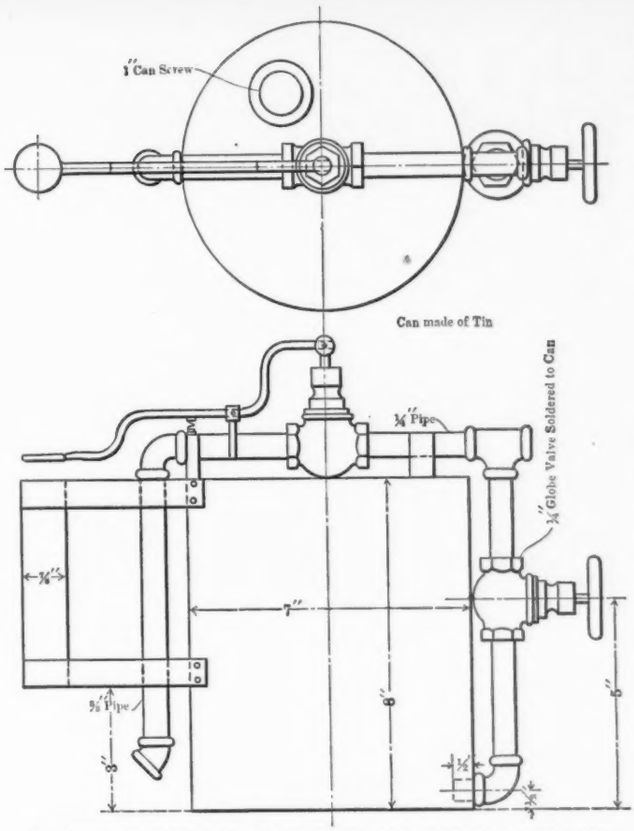
Cleaning Waste.—While waste that is used by wipers is usually considered a negligible expense, and after it has become too dirty for further wiping is used to kindle fires at most places, still at points where this subject has been carefully investigated it has been found that it is well worth while to collect the waste that is discarded by the wipers, thoroughly wash it, and put it



PORTABLE MACHINIST'S TOOL BOX—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

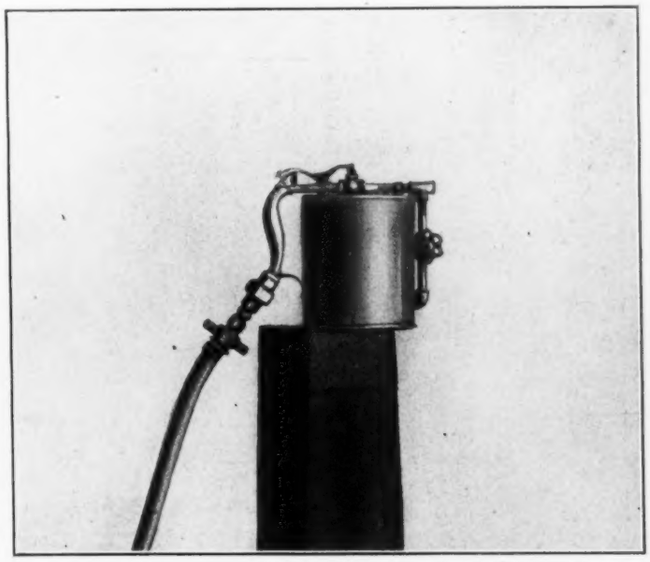
again into use. At such points fires are kindled with crude oil either poured directly on the fuel, or by means of a special firing-up machine.

The waste discarded by the wipers is put into special galvanized iron receptacles distributed throughout the house and is collected and thrown into a large vat of crude oil, where it is



SPRAYER FOR PAINTING FRONT ENDS—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

thoroughly churned up, loosened, and a large part of the dirt washed out. It is then put through an ordinary wringer and goes to another vat of oil, where it is again washed and put through a second wringer. At the second wringing it is not wrung dry, but is left in the proper condition for the wipers to use. It is then put into boxes from which the wipers draw their supply. The oil in the first vat, of course, soon becomes

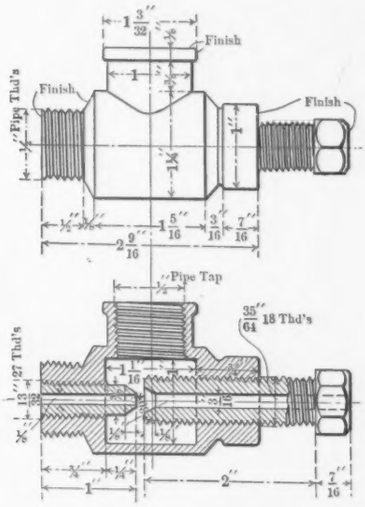


PAINT SPRAYER FOR PAINTING FRONT ENDS—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

dirty and is cleaned out periodically, usually being thrown away, although it can be filtered if desired. The oil from the second vat is then transferred to the first one and fresh oil is put in the second or rinsing vat. One man with an arrangement of this kind will take care of all of the waste used by the wipers in a large engine house.

Paint Sprayer for Front Ends.—The appearance of locomotive front ends is a matter of pride with most master mechanics and especially in the case of passenger power it is necessary to continually repaint them. On the Lake Shore & Michigan Southern Railway a spraying device has been designed for coating front ends that is most successful in every way. It is found that front ends painted with this sprayer do not blister as quickly and hold a good appearance a longer time, due to the fact that the paint is put on in a thinner and hence a more elastic coat. It is also found that it requires less paint. One man with a sprayer of this kind can paint a whole front end of a large locomotive, doing as good a job as it is possible to do, in less than five minutes.

The sprayer, which is shown in two of the illustrations, consists of a small tin can about 7 in. in diameter and 8 in. in height, provided with a nozzle and suitable pipe connections fitted with valves and connected as shown in the drawing. Connection is made to the air supply by a hose and the air valve is fitted with a spring handle operated by the thumb of the hand that is holding the sprayer. The nozzle is shown in detail; it is simply a



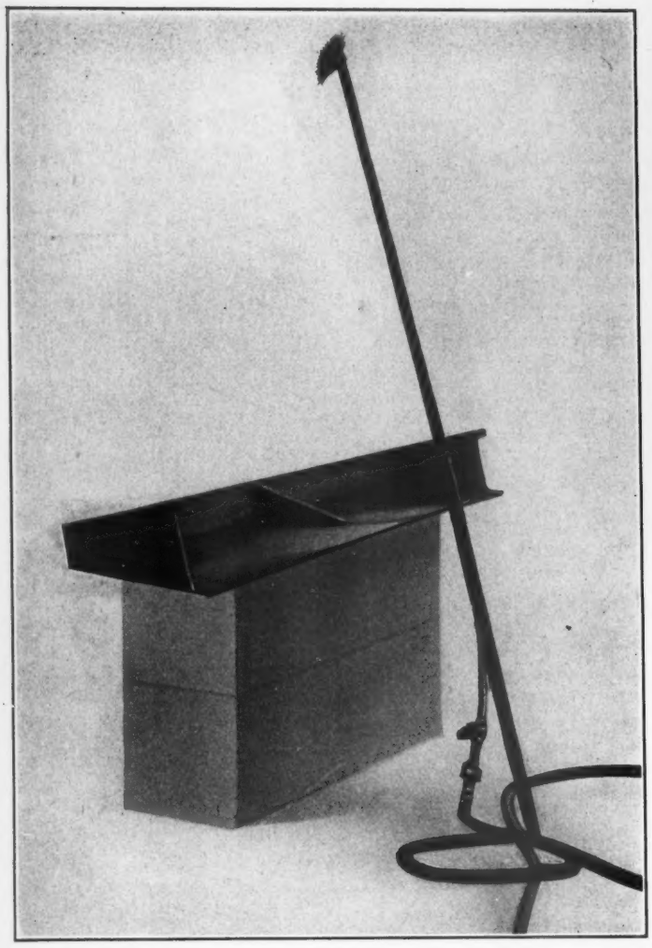
NOZZLE FOR FRONT END PAINT SPRAYER—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

brass fitting arranged on the ejector type. The whole apparatus filled with paint can easily be handled by one hand, and as the stream is not allowed to spread widely a very careful and satisfactory piece of work can be quickly accomplished with it.

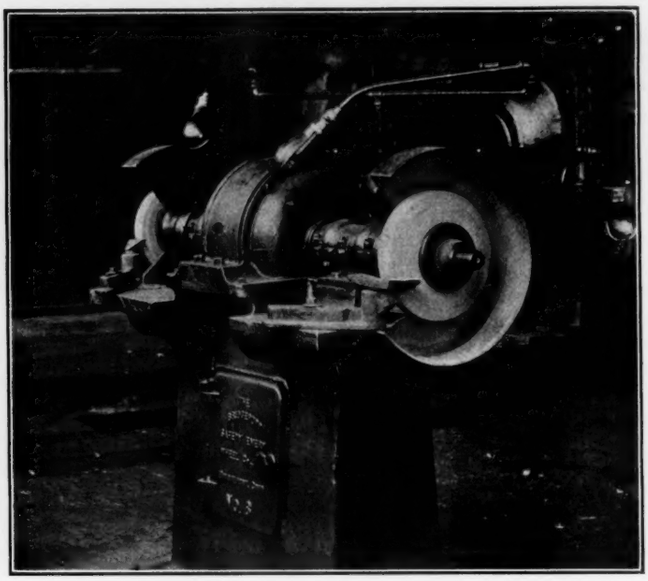
A similar sprayer is also used for tender and engine trucks, pilots, or other places where a paint sprayer can be used to advantage.

Bulletin for Boiler Washers.—In some roundhouses it is the practice to have a small blackboard properly ruled and located in a central location on which the numbers of the locomotives that are in the house and require boiler washing are noted by the work clerk. The number of the stall on which it is located is placed opposite the engine number and the boiler washing gang only have to keep track of this board for instructions. After the boiler is washed it is crossed off from the board, which acts as a notification to the foreman that the work is finished.

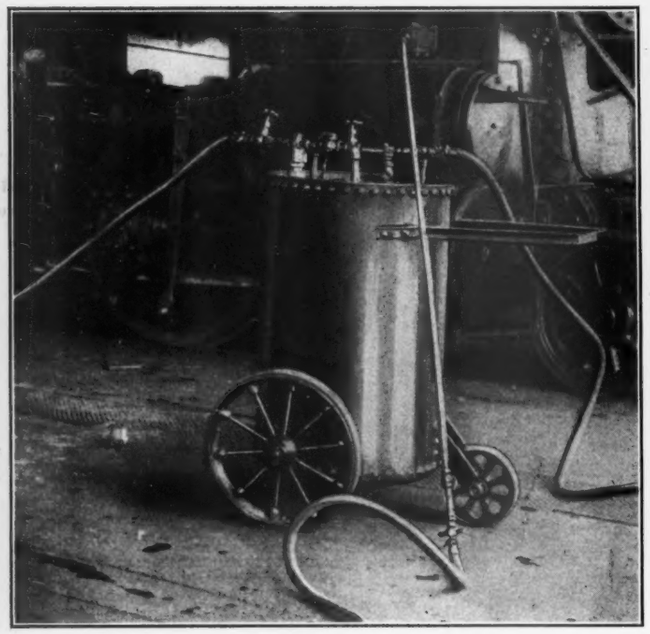
Throttle Gland Packing from Old Air Hose.—It is the practice in a number of shops and locomotive terminals to make packing for throttle stems from condemned air brake hose. For this purpose the hose is split lengthwise and the rubber washers of the proper size are made by a cutter, usually operated by air, the machine consisting simply of an eight inch brake cylinder, mounted vertically, with the cutter on the end of the piston rod and working against a wooden block. In applying packing of this kind the gland is filled up with alternate rings of washers from the hose and of one-sixteenth inch lead. It is found that this packing is cheap and answers the purpose admirably.



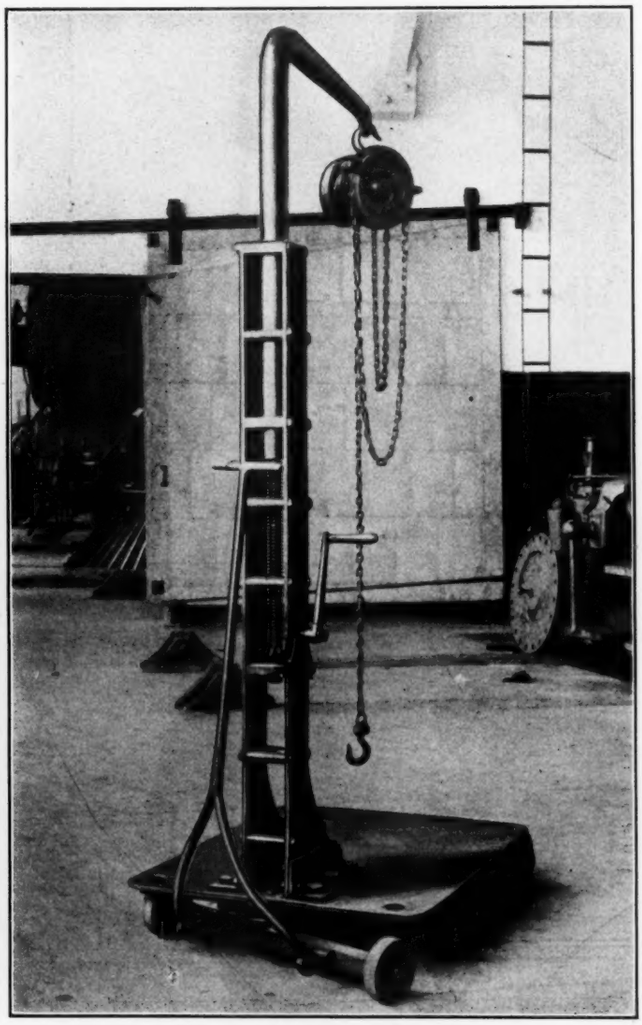
HOT WATER WINDOW WASHER USED AT ASHTABULA—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.



ELECTRICALLY DRIVEN EMERY WHEEL IN AN ENGINE HOUSE.



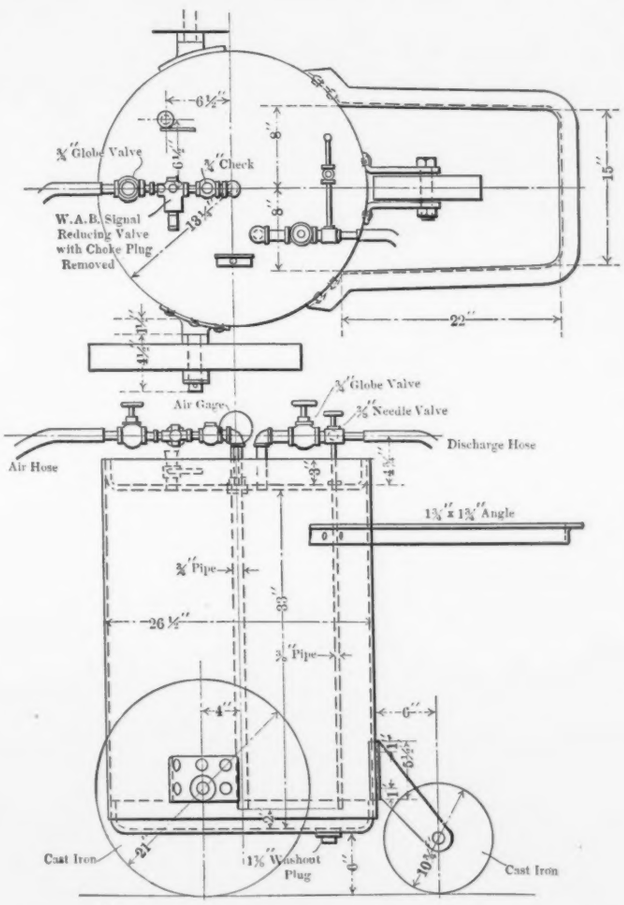
CRUDE OIL FIRING UP MACHINE, ASHTABULA ENGINE HOUSE—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.



PORTABLE CRANE FOR GENERAL WORK, WEST SPRINGFIELD ENGINE HOUSE—BOSTON & ALBANY RAILROAD.

Window Washer.—The importance of clean windows in a roundhouse can hardly be overestimated. Not only does it permit better work, but it has an indirect effect of increasing the self-respect and hence the ability of the workmen. The feeling of a man working in a roundhouse that is bright and clean and the manner in which he goes at his work is as much different from that obtained amid dirty, dark surroundings, as can be imagined. Washing off all of the windows in a large roundhouse is a big undertaking when the customary methods are used, and as it is impossible to estimate the results in dollars and cents, it is seldom that the expense is incurred of keeping the windows clean at all times, and they receive simply a periodical going over whenever a good opportunity offers.

The windows of the Ashtabula engine house on the Lake Shore & Michigan Southern Railway are always kept clean and this is accomplished by one man, whose entire time is devoted to it. He is able to obtain such excellent results largely by the use of a special swab and arrangement, which is shown in one of the illustrations. This consists first of two or three ordinary window swabs having different length handles, into the brush of which emerges a small copper pipe that is carried down the handle and having a valve at the lower end, is connected to a hose, that in turn is fastened to the hot water line of the boiler washing system. The warm water then is discharged through the brush and the windows can be quickly swabbed and rinsed without it being necessary to lower the brush to the floor.



CRUDE OIL FIRING UP MACHINE, ASHTABULA ENGINE HOUSE—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

Water running down the sash would collect in pools on the floor and form steam on the steam pipes if they are along the outer wall, and to eliminate this trouble a galvanized iron trough is provided that sets underneath and inside of the lower sash, being arranged to hook into place, and all of the water coming down the window is caught and discharged underneath the sash outside of the house.

An arrangement of this kind cannot be complimented too highly, and the results obtained far more than justify any expense incurred.

Emery Wheel in a Roundhouse.—One of the illustrations shows an electrically driven double emery wheel which is located between two of the pits in one of the sections of the Ashtabula enginehouse. This emery wheel is kept constantly in motion and an attempt is made, as far as possible, to locate locomotives which require repairs to the front end netting or diaphragm in this section. The emery wheel is largely used for grinding diaphragm plates, bolt heads, the ends of bolts and work of this character, which in most places necessitates the workman going to the machine shop. It is, of course, useful also for men working on other parts of the locomotive.

Near by it are located a small hand punch and a small shear, both sufficiently powerful to work on one-quarter inch plates. The store of plates and nettings is maintained alongside the fire wall in the same section of the house.

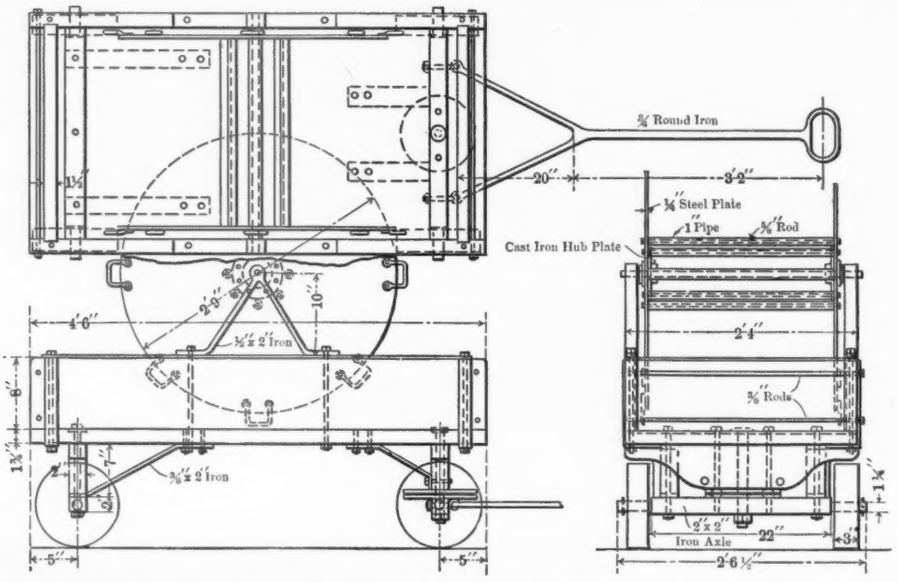
In practice it is found that both wheels of this grinder are in almost constant service and many parts are quickly ground which under other circumstances would be slowly cut with a cold chisel.

Firing Up Machine.—Firing up with crude oil is becoming quite general on a number of roads. This is usually done by soaking waste in oil and throwing it in on top of a light layer of coal in the firebox or by pouring the oil on top of the coal direct and lighting it. Both of these methods require the use of considerable oil and for the purpose of reducing this consumption and also for reducing the time for igniting the coal in the firebox a machine is in use at the Ashtabula engine house of the Lake Shore & Michigan Southern Railway and is shown in two of the illustrations. This consists of a large tank mounted on wheels, to be easily transportable around the house, which is filled with crude oil. Air pressure is carried to the bottom of the tank through a ¾-in. pipe and the mixture of air and oil is forced out through a discharge hose, the main connection being made at the top of the tank; this is supplemented by a connection through a ⅜-in. pipe which extends to the bottom of the tank and connects into the discharge line through a needle valve. This mixture of air and crude oil is then carried through a long flexible hose at the other end of which is connected a small pipe of a length which will reach to the front end of the firebox, the man handling it being on the deck plate. The end of this pipe has a small T and a number of small openings and the air and oil mixture under pressure discharging at the end is ignited and, being swept over the shallow bed of coal on top of the grate, quickly ignites it in all parts. About five minutes' work with this machine will start a glowing fire over the whole section of a large grate with the use of about one-half of the oil that would otherwise be required and in less than one-quarter of the time.

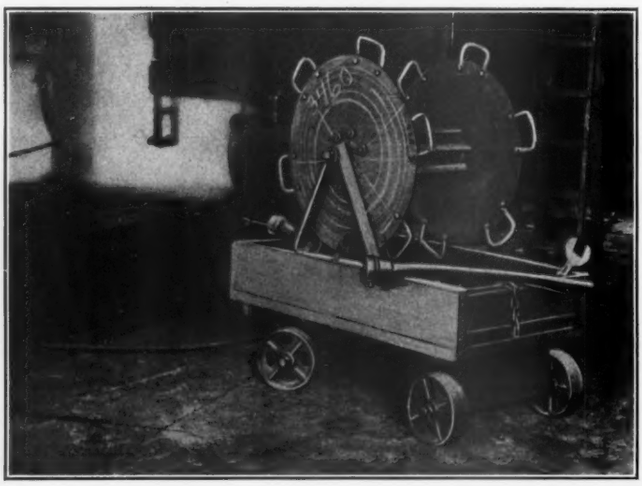
When a machine of this kind is used one man and his helper are able to fire up all of the locomotives at a large terminal, unless it is the practice to dump the fires on all engines coming into the house, in which case another machine would be required.

Portable Crane for General Work.—Most modern roundhouses are equipped with one or more portable cranes for handling cylinder heads, pistons, main rod ends and other heavy parts below the running board. A particularly well designed crane of this type, which is in use at the West Springfield engine house of the Boston & Albany Railroad, is shown in the illustration. This differs from most other designs in that the arm of the crane can be raised and lowered a distance of two feet, permitting it to have a maximum hoist and still go underneath the running board of practically any design of engine; in fact, it permits the arm to be projected into almost any place around the running gear.

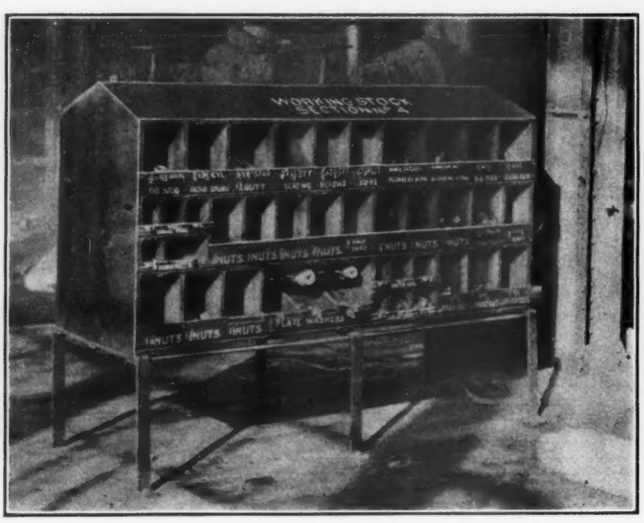
The construction is simple, consisting of a broad cart on small wheels, the front axle being pivoted and provided with a handle. Five-eighth inch boiler plate is used as the bed. At the forward end of this are two uprights of boiler plate secured together by bolts with pipe spacers. At the top of this stationary



REEL AND CART FOR BOILER WASHERS, EAST BUFFALO ENGINE HOUSE—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

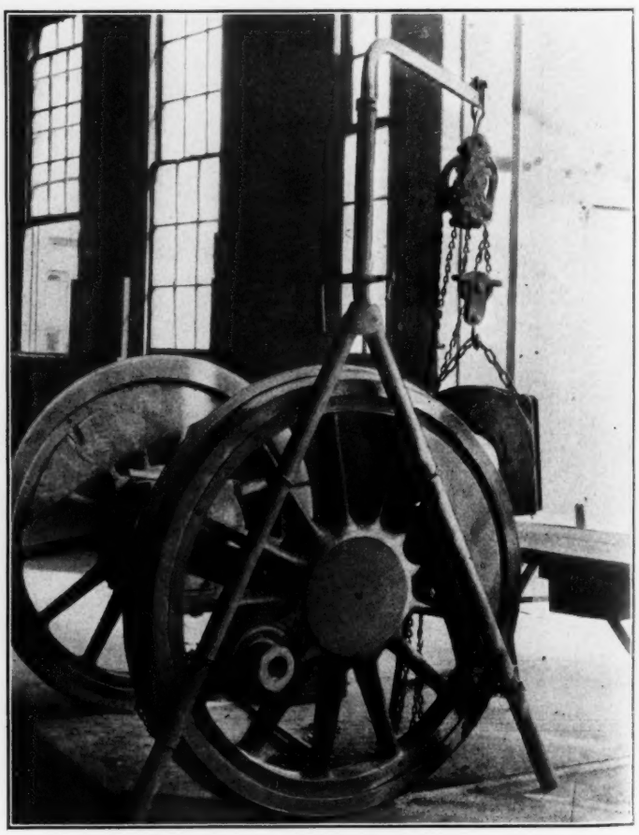


HOSE REEL AND BOILER WASHERS' CART, EAST BUFFALO ENGINE HOUSE—NEW YORN CENTRAL & HUDSON RIVER RAILROAD.



RACK FOR BOLTS, NUTS, WASHERS, ETC., AT THE EAST ALTOONA ENGINE HOUSE—PENNSYLVANIA RAILROAD.

post is a heavy plate with a hole through which the pipe crane arm passes. Similar plates guide the lower end of the arm and the screw. The arm is made of a piece of heavy Shelby steel tubing bent over at the top and equipped with a ring at the outer end into which a chain hoist is hooked. The lower end of the tube is plugged with a block into which a steel screw is threaded. This screw carries at its lower end a beveled gear meshing with a gear fastened to the handle shaft, the handle being alongside the stationary post. In this manner the arm is raised and lowered by turning the screw, and any adjustment



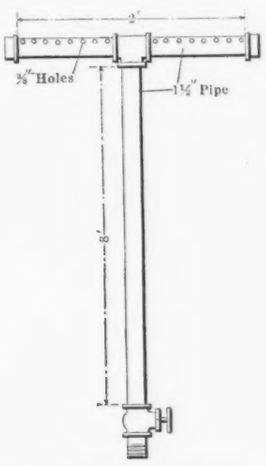
PORTABLE CRANE FOR LIFTING DRIVING BOXES, WEST SPRINGFIELD ENGINE HOUSE—BOSTON & ALBANY RAILROAD.

within two feet is easily obtained. The crane arm can be swung relative to the carriage through an arc of 90 degs., but a pin is fitted into its lower end which prevents its swinging in a complete circle. This makes it unnecessary to hold the arm when it is being raised.

The crane shown in the illustration has been tested with a 1,600 pound load without failure.

Boiler Washer's Cart.—It is not of any particular benefit to boiler washer's hose, which in any case is subject to very hard usage, to drag it over the floor of the house where it often gets caught and torn, nor is it a matter of economy to have the boiler washers chasing from one place to another until they can get their wrenches, nozzles, hooks, etc., all collected at one point. To eliminate this bad practice most of the roundhouses on the New York Central Lines are provided with a boiler washer's cart, the details of which are shown in one of the illustrations. This cart has a substantial body in which wrenches, nozzles, wires, torches, etc., are stowed, and has a large reel on which the hose can be quickly and easily rolled, not only keeping it from the floor, but also assuring that it is well drained. The cart and reel are of the home-made type, and can easily be put together in any shop.

Brick Arch Cooler.—It is often necessary for boiler makers to go into the fire box of locomotives fitted with brick arches shortly after they arrive in the house, for the purpose of rolling the flues. The arch, of course, retains its high temperature for a long time and, unless it is cooled off in some manner, makes it a physical impossibility for the men to work on it. It is expensive to remove the arch every time a few flues need rolling, and hence it has become customary at many points to cool the



BRICK ARCH COOLER.

arch with warm water and a simple cooling device which is used for this purpose at the Rensselaer roundhouse of the Boston & Albany Railroad, is shown in one of the illustrations. This is made up of pipes and pipe fittings forming a T, the cross being about two feet long, and having a number of three-eighth inch holes drilled in it. The ends are capped. The stem is about eight feet long, so that it can be put in through the fire door and have the valve at its end outside the fire box. This is connected to the hot or cold water line and the water is allowed to run over the arch until it is cooled off.

Crane for Driving Boxes.—At one round house a very handy small crane for lifting driving boxes from the axles after the wheels have been removed from the locomotive by means of the drop pit, is in use. The accompanying illustration shows its features and general construction. The vertical section of the legs is made of 2 inch pipe and the arm section of 1½ inch extra heavy pipe flattened down at the outer end. This sets down into the 2 inch pipe, a cup being driven into the latter to form a bearing for the bottom of the arm, which is simply slipped into place. One leg is hinged so as to fold up and by removing the arm the whole crane can be easily carried by one man to any point. It is but the work of a moment to set it into place alongside the wheel, the lower legs being chained to the spokes and the chain fall being hung on a hook at the end of the arm. On very large wheels a dog is provided for resting against the tire to relieve the strain on the upright. The arm is free to swing in either direction and the box after being lifted from the axle by the chain fall can be lowered to a bench, or floor within the gauge of the wheels. The crane shown in the photograph has been tested with a 700 pound weight without damage.

Rack for Nuts, Washers, Studs, Bolts, etc.—An arrangement which is most successful as a time saver is in use at the East Altoona engine house of the Pennsylvania Railroad. It consists of a covered rack with proper size pigeon holes built of wood and mounted on strap iron legs, so as to clear the floor by a foot or more, in which are kept a very complete supply of standard nuts, washers of various sizes, stud bolts, cotter pins, carriage bolts and other bolts for use by the roundhouse forces as required. There is one of these racks every seven or eight stalls located alongside of the post on the outer circle, all of which are kept well stocked. This material is drawn from the storehouse on a blanket order and used by the workmen without further record. The sweepers return all good material of this character that is picked up on the floor to its proper place in these racks. This simple scheme saves in the aggregate an enormous amount of travel by the workmen of a busy roundhouse. One of the illustrations shows the appearance of the rack.

LOCOMOTIVE TERMINALS.

TO THE EDITOR:—

In the article on "Locomotive Terminals" in your February number, in connection with the paragraph on "Design of Locomotive," page 49, you refer to the large dump grates in both ends of the firebox, which are of great assistance in cleaning clinkery fires; this matter has been thrashed out by the mechanical men of the country, and about 75 per cent. of them believe that a dump grate is not necessary, and I imagine there are very few but what are of the opinion that a dump grate next to the flue sheet is a prime factor in the leaky flue question, both because of the amount of dead ashes and dirt that is carried there, and the impossibility of shaking the grate with the rest of the grates.

Referring to mechanical coal docks; at some of these it is possible to screen the coal by drilling large holes in the apron on the horizontal trough over which the conveyor pulls the coal before depositing it in the bins; the slack coal going down through the holes, and the conveyor pulling the remaining lumps to the opening over the bin in which the coal is supposed to be dumped. Of course, this means that the bin next to the elevator would be for slack. This is a point that you probably have not noticed, and I believe one worth mentioning.

MASTER MECHANIC.

BRONZE TRIMMINGS ON THE SANTA FÉ.—An order recently issued by the Atchison, Topeka & Santa Fé will result in every car and coach on the system being sent to the shops and the brass trimmings will give way to those of a statuary bronze. The hat racks, side rods, light fixtures and every piece of brass will be taken out or covered with a coat of bronze. This will do away with the constant expense of polishing and keeping it in shape. Bronze will hold its color unaffected by the elements, and will never grow dull and distasteful to the eye. A little cleaning now and then for sanitary purposes is all that is necessary.—*Railway and Engineering Review.*

INTERNATIONAL MASTER BOILERMAKERS' ASSOCIATION.—The annual convention of the International Master Boilermakers' Association will be held at the new Clifton hotel, Niagara Falls, Ont., May 24-27, 1910.